United States Department of the Interior

Bureau of Land Management

Eastern States
Southeastern States District Office
411 Briarwood Drive, Suite 404
Jackson, Mississippi 39206
http://www.es.blm.gov

IN REPLY REFER TO:
3100 (020) AM

April 15, 2015

Memorandum

To: State Director, Eastern States (ES-930)

From: District Manager, Southeastern States

Subject: National Environmental Policy Act (NEPA) Review for Expressions of Interest (EOI) in Arkansas

We have completed our NEPA review for two EOIs in Arkansas (EOI #1552 and #1561). The Environmental Assessment (EA) is attached. This is planned for the upcoming September 2015 lease sale. Please return signed copies of the EAs to me for our records. If you have any questions, please contact Alison McCartney at (601) 977-5407.

Attachment (1)
EA Document

Preparers and Reviewers

Prepared by: Alison McCartney Date: 2/19/15
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Prepared by: Date: 2/19/15
John Sullivan
Archaeologist/Tribal Coordinator

Reviewed by: Faye Winters Date: 2/19/15
Faye Winters
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Reviewed by: Date: 2/19/15
Duane Winters
Natural Resource Supervisor

Reviewed by: Elizabeth Ivy Date: 2/27/15
Elizabeth Ivy
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United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Southeastern States Field Office
411 Briarwood Drive, Suite 404
Jackson, Mississippi 39206

Environmental Assessment
ES-020-2012-25
ES-020-2012-61

EOI #1552 and 1561, Pope and Logan Counties, Arkansas
Lease EA

Prepared by: Alison McCartney
Date: February 9, 2015

CH 1 – PURPOSE OF AND NEED FOR THE PROPOSED ACTION

1.0 Introduction

The Bureau of Land Management (BLM) Southeastern States Field Office (SSFO) received a request from the BLM Eastern States Office for a National Environmental Policy Act (NEPA) analysis report on two Expressions of Interest (EOI); EOI #1552 and EOI #1561. EOI #1552 consists of 100 acres of land with the following legal description: T7N, R26W, Sec. 22, SWNW, NWSW, Sec. 23, N2SESE, Logan County, Arkansas. EOI #1561 consists of 39.86 acres with the following legal description: T9N, R21W, Sec. 5, SWSE, Pope County, Arkansas (Appendix A).

This environmental assessment (EA) is prepared to address the two proposed federal oil and gas lease nominations noted above. A federal oil and gas lease is a legal contract that grants exclusive rights to the lessee to develop federally owned oil and gas resources.

1.1 Need for the Proposed Action

The purpose of the proposed action is to make available for lease 139.86 acres in Logan and Pope Counties, Arkansas to provide exclusive rights to the lessee to develop federally owned oil and gas resources. The development of oil and natural gas is essential to meeting the nation's future needs for energy. Private exploration and development of federal oil and gas reserves are integral to the BLM's oil and gas leasing programs under the authority of the Mineral Leasing Act (MLA) of 1920, as amended, the MLA for Acquired Lands of 1947, as amended, the Federal Land Policy and Management Act of 1976 and the Energy Policy Act of 2005. The oil and gas leasing program managed by the BLM encourages the development of domestic oil and gas reserves and reduction of U.S. dependence on foreign sources of energy.

1.2 Management Objectives of the Action

The objective of the proposed action is to make available for lease 139.86 acres in Logan and Pope Counties, Arkansas to provide exclusive rights to the lessee to develop federally owned oil and gas resources. Not approving these EOIs would deny the option for industry to develop federal minerals in this area which could create a loss of royalties to the federal government.

1.3 Land Use Plan Conformance

The proposed action does not conflict with any known state or local planning, ordinance or zoning. This area is not covered by a BLM Resource Management Plan. According to the regulations at 43 CFR 1610.8 (b) (1), however, this environmental assessment will be used as a basis for making a decision on the proposal.

1.4 Applicable Regulatory Requirements and Required Coordination

Applicable regulatory requirements and required coordination for lease development of federal oil and gas minerals is authorized by several statutes including: The MLA, as amended and supplemented (30 U.S.C. 181), The MLA of 1947, as amended (30 U.S.C. 351-359), The

National Historic Preservation Act (NHPA), The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, The Endangered Species Act (ESA), The Federal Onshore Oil and Gas Leasing Reform Act (FOOGLA), Executive Order (EO) 13007, and/or other statutes and EOs. Consultation with the Arkansas State Historic Preservation Officer (SHPO), and informal consultation with U.S. Fish and Wildlife Service (FWS), Arkansas Ecological Services was conducted and their responses are located in Appendix C.

1.5 Scoping and Public Involvement

1.5.1 Internal Scoping

In December, 2014, a BLM interdisciplinary (ID) team was formed which included a Natural Resource Specialist, Geologist, GIS Specialist, and Archeologist. The ID team began analyzing all relevant date regarding EOI #1552 and 1562 and writing portions of the EA. The final EA was reviewed by all members of the ID team with comments made and incorporated.

1.5.2 External Scoping

Informal consultation with FWS was initiated on January 16, 2015 in compliance of the ESA, Section 7 Consultation requirements. A concurrence letter was received on February 16, 2015 and is located in Appendix C. A request was submitted to the Arkansas Natural Heritage Commission (ANHC) on January 16, 2015 to review their files for records indicating the occurrence of rare plants and animals, outstanding natural communities, natural or scenic rivers, or other elements of special concern within or near the proposed parcels. A response was received on January 30, 2015. Consultation with the SHPO occurred on January 5, 2012, (EOI #1552) and January 13, 2014 (EOI #1561). Concurrence letters were received on February 12, 2012 (EOI #1552) and March 10, 2014 (EOI #1561) (Appendix C). Letters were sent to various tribes on January 5, 2012 (EOI #1552) and January 13, 2014 (EOI #1561) notifying them of the proposed action and requesting comments or concerns. Comments were received from tribes on January 25, 2012 and February 13, 2012 for EOI #1552 and February 19, 2014 (EOI #1561).

The following tribes were contacted to notify them of the proposed action and to request comments or concerns (Appendix C):

Alabama-Quassarte Tribal Town
Choctaw Nation
United Keetoowah Band of Cherokee Indians in Oklahoma
Osage Nation
Muscogee (Creek) Nation of Oklahoma
Cherokee Nation of Oklahoma
Seminole Nation of Oklahoma
Quapaw Tribe of Oklahoma
Tunica-Biloxi Tribe
Caddo Nation of Oklahoma
Thlopthlocco Tribal Town
Chickasaw Nation

Coushatta Indian Tribe
Kialagee Tribal Town

The following state and/or federal agencies were contacted by the BLM ID team:

- FWS
- Arkansas SHPO
- ANHC

1.5.3 Public Involvement

The proposed lease was subject to public review for a 30-day period per publication of a newspaper of local distribution (Appendix E).

1.6 Decision(s) That Must Be Made

There are two decisions under consideration from the BLM for the proposed action. The first is to offer the federal oil and gas mineral estate for competitive leasing. The other decision would be to deny the action so that no development and surface disturbance would take place. BLM's policy is to promote oil and gas development as long as it meets the guidelines and regulations set forth by NEPA and other subsequent laws and policies passed by the U.S. Congress.

1.7 Leasing

Analysis as required by NEPA was conducted by SSFO specialists who relied on personal knowledge of the areas involved and reviewed existing databases and file information. It is unknown when, where or if future well sites or roads might be proposed. Detailed site-specific analysis of individual wells or roads would occur when a lease holder submits an Application for Permit to Drill (APD).

CH 2 – PROPOSED ACTION

2.0 Proposed Action

The proposed action is to lease 139.86 acres of federal minerals located in Logan and Pope Counties, Arkansas (Appendix A). Once sold and a lease issued, the lease purchaser has the right to use so much of the leased lands as is reasonably necessary to explore and drill for all of the oil and gas within the lease boundaries, subject to the stipulations attached to the lease (Title 43 CFR 3101.1-4). Oil and gas leases are issued for a 10-year period and continue for as long thereafter as oil or gas is produced in paying quantities. If a lessee fails to produce oil and gas, does not make annual rental payments, does not comply with the terms and conditions of the lease, or relinquishes the lease, ownership of the minerals leased revert back to the federal government and may be leased again.

The proposed leases would give the lessee exclusive rights to explore and develop oil and gas reserves on the lease, but does not in itself authorize surface disturbing activities. Although there is no surface disturbance at this leasing stage, the BLM NEPA analysis is conducted with the consideration that there may be disturbance in the future as a result of the initial action. As a result, the NEPA analysis for these leases addresses potential effects from drilling, based on reasonably foreseeable development (RFD), although specific drilling activity is not authorized at this leasing stage. Before a lease owner or operator conducts any surface disturbing activities related to the development of this lease, BLM must first approve an APD as specified in Title 43 CFR 3162.

Upon receipt of an APD, BLM will conduct an onsite inspection with the company and surface owner, if possible. NEPA and the ESA requirements must also be met at the APD stage and in those cases where there is the potential to affect federal or state-listed species, a site specific biological assessment is written, including the results of any biological surveys that may be indicated. This is submitted to FWS and/or the state wildlife agency for consultation, as appropriate. The lessee is required, as per lease stipulations, to comply with the recommendations of these consultations.

The RFD for EOI # 1552 predicts that 2 federal horizontal wells will be drilled from 2 pads. The total disturbance predicted would be 2.87 acres, with 2.87 acres disturbed for the well pad and pit, 0.68 acres for the access road, and 0.68 acres reclaimed (Appendix D). The RFD for EOI #1561 predicts that 1 federal horizontal wells will be drilled from 1 pad. The total disturbance predicted would be 2.00 acres, with 1.43 acres disturbed for the well pad and pit, 0.91 acres for the access road, and 0.34 acres reclaimed (Appendix D).

Typically, after approval of an APD, the petroleum industry follows a general plan and process for all proposed drill sites, as follows:

Spacing for the tract will be 40 acres per well. Preparation for the drilling process includes construction of a road, drilling pad, and reserve pit. Constructed access roads normally have a running surface width of approximately 30 feet; the length is dependent upon the well site location in relation to existing roads or highways. The average length of road construction will

be about 0.5 miles. Therefore, about 2 acres would be affected by road construction. Typically 2.5 acres are cleared and graded level for the construction of the drilling pad for a well. If the well is gas and productive, and the flowline is in the road, we can estimate that another 0.5 acres may be affected by flowline construction. The total disturbed area for drilling a productive well will be approximately 5 acres. These disturbances are typical for private or federal ownership well locations. The excavation reserve pit is usually about five feet deep and is lined with bentonite clay to retain drilling fluids, circulated mud, and cuttings. Plastic or butyl liners (or its equivalent), that meet state standards for thickness and quality, are used on occasions when soils are determined incapable of holding pit fluids.

Drilling usually continues around the clock. Once drilling is completed, excess fluids are pumped out of the pit and disposed of in a state authorized disposal site and the cuttings are buried. Wells would be drilled by rotary drilling using mud as the circulating medium. Mud pumps would be used to force mud down the drillpipe, thereby forcing the rock cuttings out the wellbore. Water would normally be from a well drilled on the site, however, water could be pumped to the site from a local pond, stream or lake through a pipe laid on the surface. Approximately 1500 barrels of drilling mud would be typically kept on the location. If a tract is adjacent to a producing field and water production will be expected during the life of the field, separation, dehydration and other production processing may be necessary. Construction of facilities off the federal lease may be needed to handle this processing. Some processing or temporary storage may be necessary on site.

During well pad construction, the topsoil is stockpiled to be used during restoration activities. If the well is successful, the drill pad would be reduced to about 100' x 100' with the remaining surface area, including the reserve pit, re-graded and restored as per the BLM and surface owner requirements. A lease notice for the proposed lease encourages the use of non-invasive cover plants during all restoration and stabilization activities. Final seed mixtures and plantings are determined with recommendations from BLM with approval of the land owner. The remaining 100' x 100' pad is maintained for the life of the well. The life of a productive well may be 25 years. Following abandonment, the pad is subject to the same restoration parameters.

The following information on the federal mineral tracts is based on information collected during site visits conducted in 2014, aerial photographs, and topographic maps. Mitigation methods for potential negative impacts are listed in Appendix B as lease stipulations and lease notices. These recommended lease stipulations and notices have been developed to provide general habitat protection and setbacks to exclude sensitive habitats from oil and gas development. Recommended mitigation for the proposed action is suggested as stipulations for cultural resources and tribal consultations, endangered species, special plant species, and freshwater aquatic habitat (EOI #1561 only) (Appendix B). Additional surveys may be required for special status species after site-specific proposals have been received by BLM during the development phase.

2.1 No Action Alternative

Under the No Action alternative, surface management would remain the same. Ongoing oil and gas development, however, would continue on surrounding federal, private, and state leases, with the possibility of drainage from these adjacent wells. It is not expected that demand for energy oil and gas will go down, and a decision to not lease the proposed federal minerals would not prevent future leasing in these areas provided it is consistent with land use planning decisions, and subject to appropriate stipulations. Therefore, it is anticipated that these parcels may be nominated and leased at a future date.

CH. 3 – DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.0 Introduction

This section describes the environment that would be affected by implementation of the Proposed Action described in Chapter 2. Aspects of the affected environment described in this section focus on the relevant resources and issues. Only those elements of the affected environment that have the potential to be significantly impacted are described in detail.

Based on review of environmental elements and consideration of the Purpose and Need statement prepared for this EA, the following elements will be addressed in this EA: Environmental Justice, Cultural Resources and Native American Concerns, Minerals and Mineral Development, Wastes, Soils, Air Resources, Water Resources - Surface/Ground, Wetlands/Riparian Areas/Floodplains, Invasive/Exotic Species, Special Status Species, Vegetation and Wildlife, and Migratory Birds of Concern.

3.1 Description of Project Area

EOI #1552 is located in Logan County and EOI #1561 is located in Pope County in northwest Arkansas in the Arkansas Valley Ecoregion. The Arkansas Valley Ecoregion is composed of plains, hillsides, floodplains, terraces and scattered mountains (Anderson 2006). It is underlain by interbedded Pennsylvanian sandstone, shale and siltstone. Prior to the 19th century, uplands were dominated by forested areas, woodlands, savannas and prairie land and floodplains and lower terraces were dominated by bottomland hardwood forests (Anderson 2006). Currently, many upland areas have been cleared for pasture or hay land with poultry and livestock farming also prevalent.

3.1.1 EOI #1552

This 100 acre tract is located in Logan County and consists of 2 parcels separated by ~2 miles (Appendix A). Both parcels are located ~3 miles south of Paris, Arkansas. The west parcel consists of ~80 acres with Highway 109 running east/west diagonally through the center of the tract (Appendix A). A gravel road is located along the western and southern boundaries. A power line runs east/west through the northern quarter of the tract. The parcel consists of loblolly pine (*Pinus taeda*) plantations and logged areas. Logging of portions of the tract was occurring while the site visit was being conducted on April 23, 2014. The surrounding area within a two mile buffer is primarily cleared land to the west and east and primarily forested to the north. Lands south of the tract is partly cleared and partly forested. The second parcel is located <2 miles east and consists of ~20 acres. County roads are located just outside portions of the southwest and southeast boundaries. A gas line runs north/south through the western quarter of the tract (Appendix A). A dirt road runs from the southwest to northwest corners. The parcel consists of pine-mixed hardwood forest. The surrounding area within a two mile buffer contains some cleared areas for agriculture and timber and some forested areas.

3.1.2 EOI #1561

EOI #1561 consists of 39.86 acres in Pope County ~10 miles east of Clarksville (Appendix A). An electrical power line runs north/south in the western quarter of the tract. This parcel consists of a pine-mixed hardwood forest. Within a two mile buffer surrounding the parcel, lands to the south are primarily forested and land to the north is primarily cleared for cattle pastures and hayland. Acreages to the east and west are a mix of cleared and forested land. Big Piney Creek is located <1 mile south of the tract.

3.2 Environmental Justice

Title IV of the Civil Rights Act of 1964 and related statutes ensure that individuals are not excluded from participation in, denied the benefit of, or subjected to discrimination under any program or activity receiving federal assistance on the basis of race, color, national origin, age, sex, or disability. EO 12898 on Environmental Justice directs that programs, policies, and activities not have a disproportionately high and adverse human health and environmental effect on minority and low-income populations.

The closest town to both EOIs which has U.S. Census Bureau (USCB) data is Clarksville which is located ~ 18 northeast of EOI #1552 and 10 miles west of EOI #1561 is Clarksville. According to The U.S. Census Bureau (USCB), Clarksville had an estimated population of 9,324 in 2013 with 22.2% of people living below the poverty level from 2009 – 2013 (USCB 2014). This is a higher percentage than the state as a whole (19.2%). Oil and gas development in southwest Arkansas would have impacts on employment and associated income, payments in lieu of taxes to the parishes, population numbers, and lifestyles.

3.3 Cultural Resources and Native American Concerns

3.3.1 Cultural Resources

A cultural resource is a broad term that refers to areas of traditional significance, use and the remains of past and current human activity. These resources may be the physical remains of a prehistoric or historic archeological site or a place of traditional cultural significance or use. A Traditional Cultural Property (TCP) refers to the connection between places on the landscape and a group's traditional beliefs, religion, or cultural practice. Because cultural resources are nonrenewable and easily damaged, laws and regulations exist to help protect them.

The NHPA, as amended, and its implementing regulations require that federal agencies consider the effects of their undertakings on "historic properties." 492 FS0026863. The term "historic properties" refers to cultural properties, both prehistoric and historic, that are eligible for listing in the National Register of Historic Places (NRHP). The lands, resources, and archeological sites in northwest Arkansas are considered traditionally significant to all affiliated American Indian Tribes and, in some cases, certain resources or areas are considered sacred to a specific Tribe(s). These traditional sacred places and traditional use areas are considered cultural historic properties that may be eligible for the NRHP, because of their association with cultural practices and beliefs rooted in history and their importance in maintaining the cultural identity of ongoing

American Indian communities. Consultations about these uses and places are governed and/or mandated by the NHPA, as amended in 1992 (U.S.C. 470 et seq.), the American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996), the Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001 et seq.) and EOs 13007, 13175, 13084, and 13647. Federal agencies consider the effects of their management activities on historic properties by first determining the area of potential effect, then conducting literature searches and field surveys to locate cultural properties. Additionally, they consult with American Indian Tribes and other interested parties to determine whether TCPs are within the area of potential effect.

All historic and archeological sites that are eligible or potentially eligible for listing in the NRHP would be either avoided by the proposed undertaking or have the information in the sites extracted through data recovery prior to subsurface disturbance.

The proposed lease sites have not been surveyed and there are no recorded sites within one mile of the lease areas. The lease areas may have sites that would qualify as historic properties (36 CFR 61). Professionally conducted surveys for historic properties and cultural resources would be required before any ground disturbing activities take place. This information would enhance our understanding of human land use utilization in prehistoric Arkansas.

3.3.2 Native American Concerns

Federally recognized Native Americans have been contacted about this proposed undertaking. However, currently, there are no known sites for religious purposes, Sacred Sites or TCPs identified by Native Americans on the lease tracts. If any such sites are present, access would be by an agreement between the surface owner and those Native Tribal groups. The BLM has no authority over access. The BLM's responsibility is limited to the subsurface disturbance, if or when a proposal for development is submitted.

3.4 Minerals and Mineral Development

3.4.1 Minerals

The objective horizon is Middle Atoka for EOI #1552 and Pennsylvanian Atokan or Morrowan Sands for EOI #1561. The commodity for both is oil and natural gas.

3.4.2 Mineral Development

Wells will be drilled vertically to a certain depth referred to as the kick-off point. From there the wells are steered from the vertical to the horizontal using a short, medium, or long radius curve. A horizontal lateral is then drilled in the objective horizon for a distance of between 4,000 and 9,000 feet. These wells may require high volume hydraulic stimulation/fracturing in order to establish commercial production. Hydraulic stimulation occurs after a well has been drilled to a particular depth vertically and possibly drilled a certain distance horizontally through the targeted geologic zone (Figure 1). Steel pipe (casing) will be inserted in the well bore and will be perforated within the target zone(s) that contain oil or gas, enabling production out of the targeted zone(s) when the fracturing fluid is injected at high pressure into the well flowing

through the perforations. Eventually, the targeted formation will not be able to absorb the fluid as quickly as it is being injected and at this point, the pressure created causes the formation to crack or fracture. Once the fractures have been created, injection ceases and some quantity of the fracturing fluids will begin to flow back to the surface. Materials called proppants (e.g., usually sand or ceramic beads), which were injected as part of the fracturing fluid mixture, remain in the target formation to hold open the fractures.

Some studies have shown that anywhere from 20-85% of fracturing fluids may remain underground. Used fracturing fluids that return to the surface are often referred to as flowback, and these wastes are typically stored in open pits or tanks at the well site prior to proper disposal or can be reused in developing other wells.

The subject parcels do not contain any existing features related to energy development, production, supply or distribution including plugged or unplugged oil and gas wells.

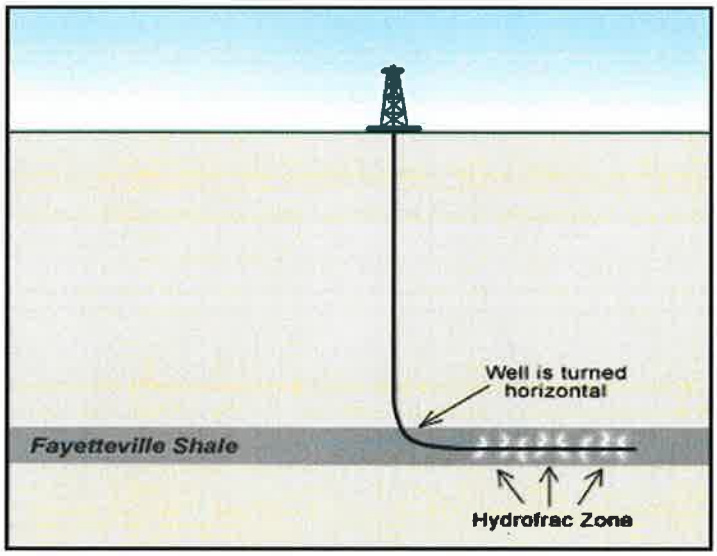

Figure 1. Diagram of hydraulically fracturing a well.

3.5 Wastes

The Resource Conservation and Recovery Act (RCRA) of 1976 established a comprehensive program for managing hazardous wastes from the time they are produced until their disposal. The Environmental Protection Agency (EPA) regulations define solid wastes as any "discarded materials" subject to a number of exclusions. On January 6, 1988, EPA determined that oil and gas exploration, development and production wastes would not be regulated as hazardous wastes under the RCRA. The Comprehensive Environmental Response Compensation and Liability Act (CERCLA) of 1980, deals with the release (spillage, leaking dumping, accumulation, etc.), or threat of release of hazardous substances into the environment. Despite many oil and gas constituent wastes being exempt from hazardous waste regulations, certain RCRA exempt contaminants could be subject to regulations as a hazardous substance under CERCLA.

During the on-site inspections, no hazardous or solid waste disposal sites were found on the lease tracts. Should the parcels be leased and developed, generation and temporary storage of waste

materials (solid and liquid) would likely occur. Waste materials would be managed in accordance with Onshore Orders 1 & 7, RCRA, applicable Arkansas Department of Environmental Quality (ARDEQ) regulations, and the Arkansas Department of Natural Resources Office and Conservation (ARDNROC) rules. Fluid handling would be evaluated at the development stage and fluids associated with any subsequent drilling, completions and/or production would either be treated, evaporated, or transferred to an approved ARDEQ treatment facility. Solids would be treated on site or transferred to a ARDEQ approved facility.

3.6 Soils

The soil characteristics, potential for erosion, and likelihood for success in revegetation efforts are important to consider when planning for stabilization of disturbed areas. Oil and gas activities may affect soil chemical and physical properties causing increases in compaction, displacement, erosion, and sedimentation. Erosion and sedimentation can be quantified by measuring or by estimating tons per acre of soil loss. The comparison of soil loss tolerance (maximum rate of soil loss that can occur while sustaining productivity) to current soil loss (the rate of soil loss occurring under existing conditions) is important in describing current conditions. When current soil loss is greater than the tolerance threshold, erosion can be considered excessive. Other factors to be considered when determining whether soil erosion is too high, include the quality of the downstream water bodies and their reasons for impairment.

3.6.1 EOI #1552

3.6.1.1 T7N, R26W, Sec. 22, SWNW, NWSW

Four soil types can be found on this parcel; Enders silt loam, 8-20% slopes (comprises 13% of the tract), Leadvale silt loam, 1-3% and 3-8% slopes (63%), and Mountainburg gravelly fine sandy loam, 3-8% slopes (24%). Enders silt loam, 8-20% slopes is found on side slopes and crests of hills and has a parent material of clayey residuum weathered from acid shale. It is well drained and contains a moderate available water storage in profile (about 6.3 in). Leadvale silt loam, 1-3% and 3-8% slopes is found on stream terraces and has a parent material of old fine-silty alluvium derived from shale and siltstone over residuum weathered from sandstone and shale. It is moderately well drained with a low available water storage in profile (~5.2 in.). Mountainburg gravelly fine sandy loam, 3-8% slopes is found on hillslopes and has a parent material of gravelly and stoney, loamy residuum weathered form sandstone. It is well drained with a very low available water storage in profile (~1.4 in).

3.6.1.2 T7N, R26W, Sec. 23, N2SESE

There are two primary soil types for this parcel: Enders gravelly silt loam, 8-20% slopes (comprises 43% of the tract) and Enders stony silt loam, 12-45% slopes (57%). Enders gravelly silt loam, 8-20% slopes and Enders stony silt loam, 12-45% slopes can be found on hills and has a parent material of clayey residuum weathered from acid shale. It is well drained. Enders gravelly silt loam has a moderate available water storage in profile (~6.1 in) and Enders stony silt loam has a low available water storage profile (5.9 in.).

3.6.2 EOI #1561

There are three soil types for this parcel: Linker fine sandy loam, 3-8% slopes (comprises 16% of tract), Nella gravelly fine sandy loam, 3-8% slopes (48%), and Nella-Mountainburg association, steep (38%). Linker fine sandy loam, 3-8% slopes is found on mountains and hills and has a parent material of loamy residuum weathered form sandstone. It is well drained and contains a low available water storage in profile (about 5.0 in). Nella gravelly fine sandy loam, 3-8% slopes is found onhillslopes and mountain slopes and has a parent material of loamy slope alluvium derived from sandstone and shale. It is well drained with a moderate available water storage in profile (~7.1 in.). Nella-Mountainburg association, steep is found on mountains and has a parent material of loamy colluvium derived from sandstone and shale and/or laomy residuum weathered from sandstone and shale. It is moderately well drained with a high available water storage in profile (~7.2 in).

3.7 Air Resources

3.7.1 Air Quality

In the general area of the parcels, the primary sources of air pollution are dust from blowing wind on disturbed or exposed soil, exhaust emissions from motorized equipment, oil and gas development, agriculture, and industrial sources. The EPA was given the authority for air quality protection with the provision to delegate this authority to the state as appropriate under U.S. law. The ARDEQ has been delegated most of the authority for air quality protection in Arkansas. The Clean Air Act (CAA) of 1970, as amended, requires the establishment of National Ambient Air Quality Standards (NAAQS). NAAQS pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} & $PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb). The NAAQS pollutants are monitored in Arkansas by the ARDEQ. The CAA identifies two types of national ambient air quality standards. Primary standards define levels of air quality that the Administrator of the EPA judges to be necessary, with an adequate margin of safety, to protect the public health. Secondary standards define levels of air quality that the Administrator of the EPA judges to be necessary to protect the public from any known or anticipated adverse effects of a pollutant. Both primary and secondary standards are currently in effect (Table 1).

Table 1. National Ambient Air Quality Standards.

	Primary Standards		Secondary Standards	
Pollutant	**Level**	**Averaging Time**	**Level**	**Averaging Time**
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour (1)	None	
	35 ppm (40 mg/m^3)	1-hour (1)		
Lead	0.15 µg/m^3 (2)	Rolling 3-Month Average	Same as Primary	
	1.5 µg/m^3	Quarterly Average	Same as Primary	
Nitrogen Dioxide	53 ppb (3)	Annual (Arithmetic Average)	Same as Primary	

	100 ppb	1-hour [4]	None	
Particulate Matter (PM_{10})	150 $\mu g/m^3$	24-hour [5]	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15.0 $\mu g/m^3$	Annual [6] (Arithmetic Average)	Same as Primary	
	35 $\mu g/m^3$	24-hour [7]	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour [8]	Same as Primary	
	0.08 ppm (1997 std)	8-hour [9]	Same as Primary	
	0.12 ppm	1-hour [10]	Same as Primary	
Sulfur Dioxide	0.03 ppm	Annual (Arithmetic Average)	0.5 ppm	3-hour [1]
	0.14 ppm	24-hour [1]		

Note:

(1) Not to be exceeded more than once per year.

(2) Final rule signed October 15, 2008.

(3) The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

(4) To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm (effective January 22, 2010).

(5) Not to be exceeded more than once per year on average over 3 years.

(6) To attain this standard, the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m3.

(7) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m3 (effective December 17, 2006).

(8) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm. (effective May 27, 2008).

(9) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
(b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes
rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.
(c) EPA is in the process of reconsidering these standards (set in March 2008).

(10) EPA revoked the 1-hour ozone standard in all areas, although some areas have continuing obligations under that standard ("anti-backsliding").
(b) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is ≤ 1.

Air quality in a given region can be measured by its Air Quality Index (AQI) value. The AQI is reported according to a 500-point scale for each of the major criteria air pollutants, with the worst denominator determining the ranking. For example, if an area has a CO value of 132 on a given day and all other pollutants are below 50, the AQI for that day would be 132. The AQI scale breaks down into four categories: good (AQI<50), moderate (50-100), unhealthy for sensitive groups (100-150), and unhealthy (>150). The AQI is a national index and the air quality rating is an important indicator for populations sensitive to air quality changes. Current AQI data is not available for Arkansas.

3.7.1.1 Visibility

Visibility, also referred to as visual range, is a subjective measure of the distance that light or an object can clearly be seen by an observer. Light extinction is used as a measure of visibility and is calculated from the monitored components of fine particle mass (aerosols) and relative humidity. It is expressed in terms of deciviews, a measure for describing perceived changes in visibility. One deciview is defined as a change in visibility that is just perceptible to an average person, which is approximately a 10% change in light extinction. Visibility can also be defined by Standard Visual Range (SVR) measured in miles, which is the farthest distance at which an observer can see a black object viewed against the sky above the horizon. Cleaner air will have a larger SVR. To estimate potential visibility impairment, monitored aerosol concentrations are used to reconstruct visibility conditions for each day monitored. The aerosol species include ammonium sulfate, ammonium nitrate, organic mass, elemental carbon, soil elements, and coarse mass. The daily values are then ranked from clearest to haziest and divided into three categories; the mean visibility for all days (average), the 20% of days with the clearest visibility (20% clearest), and the 20% of days with the worst visibility (20% haziest).

A wide variety of pollutants can impact visibility, including particulate matter, NO_2, nitrates (compounds containing NO_3), and sulfates (compounds containing SO_4). Fine particles suspended in the atmosphere decrease visibility by blocking, reflecting, or absorbing light. Two types of visible impairment can be caused by emission sources: plume impairment and regional haze. Plume impairment occurs when a section of the atmosphere becomes visible due to the contrast or color difference between a discrete pollutant plume and a viewed background, such as a landscape feature. Regional haze occurs when pollutants from widespread emission sources become mixed in the atmosphere and travel long distances.

There are three classifications of areas that attain NAAQS: Class I, Class II, and Class III. Congress established certain national parks and wilderness areas as mandatory Class I areas where only a small amount of air quality degradation is allowed. Since 1980, the Interagency Monitoring of Protected Visual Environments (IMPROVE) network has measured visibility in Class I areas. These are managed as high visual quality under the federal visual resource management (VRM) program. The CAA 1997 amendment declared "as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I federal areas...from manmade air pollution." 42 U.S.C. § 7491(a)(1).25. All other areas of the U.S. are designated as Class II, which allow a moderate amount of air quality degradation. No areas of the U.S. have been designated Class III, which would allow more air quality degradation. The CAA gives federal managers the affirmative responsibility, but no regulatory authority, to protect air quality-related values, including visibility, from degradation.

There are 2 Class I areas listed for Arkansas; Caney Creek Wilderness Area (WA) and Upper Buffalo WA. Caney Creek WA consists of 4,344 acres of Forest Service (FS) land and is located over 110 miles north/northwest of both EOIs. Upper Buffalo WA consists of 9,912 acres of FS Land and is located over 60 miles north/northeast of the proposed sites.

The Buffalo River WA is the only site in Arkansas in which visibility data is available for. In 1997 (last year data is available for), sulfates were the primary pollutant contributing to reduced visibility (representing 61%) (Figure 2). Sulfates were predominantly produced from utility and industrial boilers. Nitrates were the second highest pollutant contributing to reduced visibility (20%). Nitrates were predominantly produced from automobiles and utility and industrial boilers. Other contributing pollutants included organic carbon particles, elemental carbon, and crustal material. Visual range was monitored at this WA from 1992 – 1997 (Figure 3). Visual range or distance ranged from 11 – 63 miles during this time period. The differences in visual range was caused by the amount of air pollution in the form of haze.

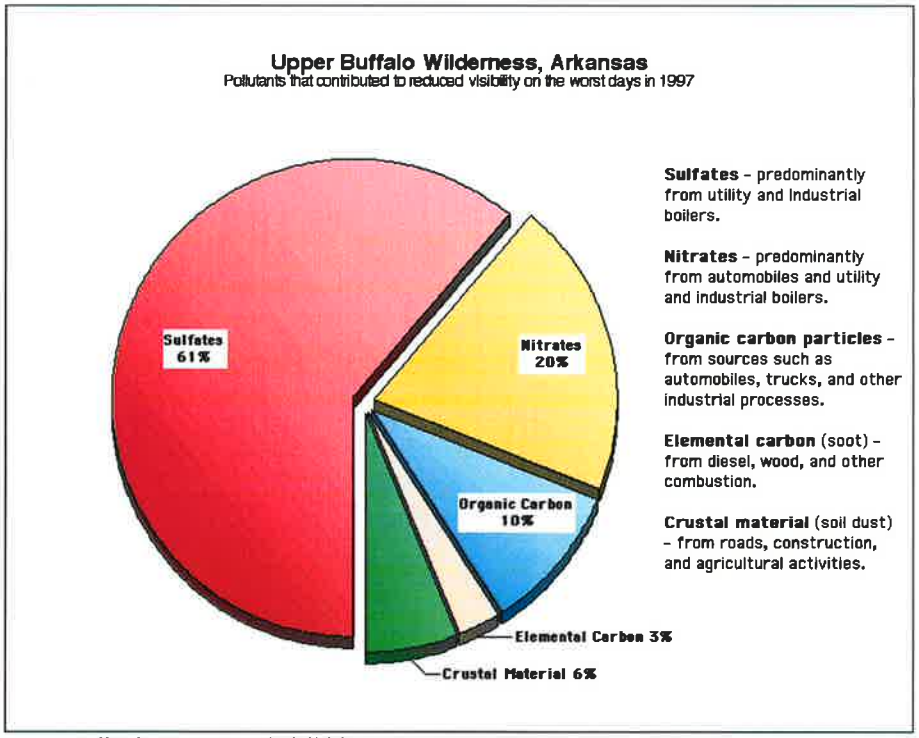

Figure 2. Pollutants contributing to reduced visibility at the Upper Wilderness Area in northern Arkansas in 1997.

Prevention of Significant Deterioration (PSD) increments limit air quality degradation and ensure that areas with clean air continue to meet NAAQS, even during economic development. The PSD program goal is to maintain pristine air quality required to protect public health and welfare from air pollution effects and "to preserve, protect and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreation, scenic or historic value."

PSD increments have been established for NO_2, SO_2, and PM_{10}. Comparisons of potential PM_{10}, NO_2, and SO_2 concentrations with PSD increments are intended only to evaluate a threshold of concern. The allowable PSD increment depends on an area's classification. Class I areas have lower increments, due to their protected status as pristine areas. PSD increment data is currently not available for Arkansas.

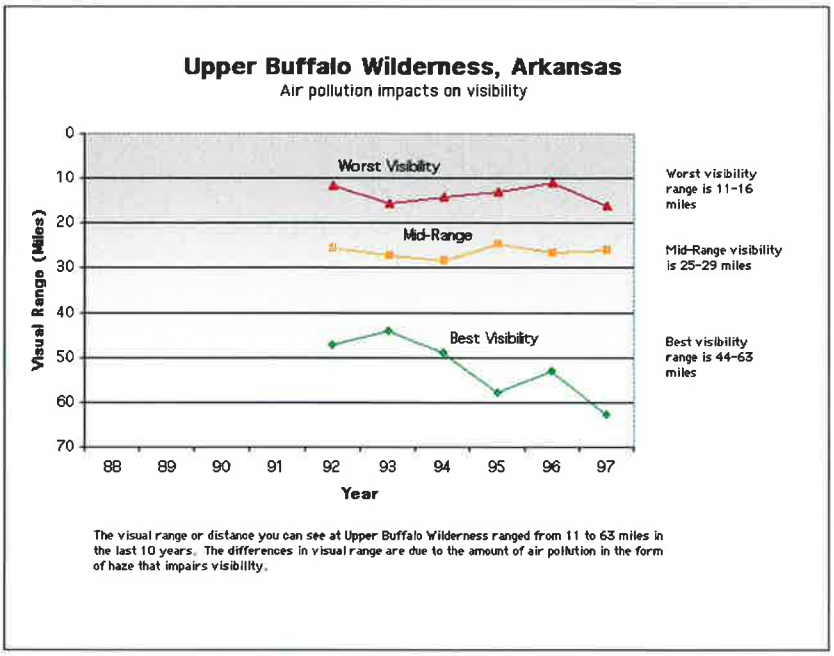

Figure 3. Visual range or distance observed at the Upper Buffalo Wilderness Area from 1992 – 1997.

3.7.1.2 Atmospheric Deposition

Atmospheric deposition refers to processes in which air pollutants are removed from the atmosphere and deposited into terrestrial and aquatic ecosystems. Air pollutants can be deposited by precipitation (rain and snow) or the gravitational settling of gaseous pollutants on soil, water, and vegetation. Much of the concern about deposition is due to secondary formation of acids and other compounds from emitted nitrogen and sulfur species, such as oxides of nitrogen (NOx) and SO_2, which can contribute to acidification of lakes, streams, and soils and affect other ecosystem characteristics, including nutrient cycling and biological diversity.

Substances deposited include:

- Acids, such as sulfuric (H_2SO_4) and nitric (HNO_3), sometimes referred to as acid rain
- Air toxics, such as pesticides, herbicides, and volatile organic compounds (VOC)
- Heavy metals, such as mercury
- Nutrients, such as NO_3- and ammonium (NH_{4+})

The accurate measurement of atmospheric deposition is complicated by contributions to deposition by several components including but not limited to rain, snow, cloud water, particle settling, and gaseous pollutants. Deposition varies with precipitation and other meteorological variables (e.g., temperature, humidity, winds, and atmospheric stability), which in turn, vary with elevation and time.

The FS has established guidelines or Levels of Concern (LOC) for total deposition of nitrogen and sulfur compounds in Class I Wilderness Areas. Total nitrogen deposition of 1.5 kilograms (kg) per hectare (ha) per year or less is considered to be unlikely to harm terrestrial or aquatic ecosystems. For total sulfur deposition, the LOC is 5 kg per ha per year. The FS is considering a sulfur LOC of 1.5 kg per ha per year. Note that these are the same LOCs the National Park Service uses. Caney Creek and Upper Buffalo WA are the only WAs in Arkansas and LOC data is not available for these areas.

3.7.2 Climate and Climate Change

3.7.2.1 Climate

On average, there are 217 sunny days per year in Arkansas. The July high is around 92 degrees. The January low is 29. Arkansas gets 49 inches or rain per year and 4 inches of snowfall. The number of days with any measurable precipitation is 91.

3.7.2.2 Climate Change

Climate change refers to any significant change in measures of climate (e.g., temperature or precipitation) lasting for an extended period (decades or longer). Climate change may result from natural processes, such as changes in the sun's intensity, natural processes within the climate system (such as changes in ocean circulation), and human activities that change the atmosphere's composition (such as burning fossil fuels) and the land surface (such as urbanization) (Intergovernmental Panel on Climate Change [IPCC] 2013).

Greenhouse gases (GHGs) are gases in the atmosphere composed of molecules that absorb and reradiate infrared electromagnetic radiation. When present in the atmosphere the gas contributes to the greenhouse effect. The greenhouse effect is a process by which thermal radiation from a planetary surface is absorbed by atmospheric GHGs and is re-radiated in all directions. Since part of this re-radiation is back towards the surface and the lower atmosphere, it results in an elevation of the average surface temperature above what it would be in the absence of the gases. Some GHGs such as CO_2 occur naturally and are emitted to the atmosphere through natural processes and human activities. Other GHGs (e.g., fluorinated gases) are created and emitted solely through human activities. The primary GHGs that enter the atmosphere as a result of anthropogenic activities include CO_2, CH_4, N_2O, and fluorinated gases such as hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulfur hexafluoride (SF). Fluorinated gases are powerful GHGs that are emitted from a variety of industrial processes including production of refrigeration/cooling systems, foams and aerosols. Fluorinated gases are not primary to the activities authorized by the FS or BLM and will not be discussed further in this document.

Ongoing scientific research has identified the potential impacts of anthropogenic GHG emissions and changes in biological sequestration due to land management activities on global climate. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG

levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused CO_2 equivalent (CO_2e) concentrations to increase dramatically, and are likely to contribute to overall global climatic changes. CO_2e is the metric measurement used to compare the emissions for various GHGs based upon their global warming potential (GWP). The CO_2e for a gas is derived by multiplying the tons of the gas by the GWP. The IPCC recently concluded that "warming of the climate system is unequivocal" and "most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations" (IPCC 2013).

It is important to note that GHGs will have a sustained climatic impact over different temporal scales. For example, recent emissions of CO_2 can influence climate for 100 years. In contrast, black carbon is a relatively short-lived pollutant, as it remains in the atmosphere for only about a week. It is estimated that black carbon is the second greatest contributor to global climate change behind CO_2 (Ramanathan and Carmichael 2008). Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of GHGs are likely to accelerate the rate of climate change.

Global mean surface temperatures have increased nearly 1.0°C (1.8°F) from 1890 to 2006 (Goddard Institute for Space Studies 2007). In 2001, the IPCC indicated that by the year 2100, global average surface temperatures would increase 1.4 to 5.8°C (2.5 to 10.4°F) above 1990 levels. The National Academy of Sciences (2006) has confirmed these findings, but also indicated that there are uncertainties regarding how climate change may affect different regions. Observations and predictive models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Data indicates that northern latitudes (above 24° N) have exhibited temperature increases of nearly 1.2°C (2.1°F) since 1900, with nearly a 1.0°C (1.8°F) increase since 1970 alone. It also shows temperature and precipitation trends for the conterminous U.S. For both parameters we see varying rates of change, but overall increases in both temperature and precipitation.

The lack of scientific tools designed to predict climate change at regional or local scales limits the ability to quantify potential future impacts. However, potential impacts to air quality due to climate change are likely to be varied. Oil and gas development activities can generate CO_2 and CH_4. CO_2 emissions result from the use of combustion engines, while CH_4 can be released during processing and development/production of oil and gas resources. Wild land fires also are a source of other GHG emissions, while livestock grazing is a source of CH_4. Currently, the LDEQ does not have regulations regarding GHG emissions, although these emissions are regulated indirectly by various other regulations.

Because GHGs circulate freely throughout Earth's atmosphere, the planning area for this resource is the entire globe. The largest component of global anthropogenic GHG emissions is CO_2. Global anthropogenic carbon emissions reached about 7,000,000,000 metric tons per year in 2000 and about 9,000,000,000 metric tons per year in 2008 (Boden et al 2010). Oil and gas production is a major contributor of GHGs. In 2006, natural gas production accounted for 8% of global CH_4 emissions, and oil production accounted for 0.5% of global CH_4 emissions (URS Corporation 2010).

3.8 Water Resources - Surface/Ground

The ARDNROC regulates oil and gas operations in state. The ARDNROC has the responsibility to gather oil and gas production data, permit new wells, establish pool rules and oil and gas allowables, issue discharge permits, enforce rules and regulations of the division, monitor underground injection wells, and ensure that abandoned wells are properly plugged and the land is responsibly restored. The Arkansas Environment Department (ARED) administers the major environmental protection laws. The Water Quality Control Commission (WQCC), which is administratively attached to the state, assigns responsibility for administering its regulations to constituent agencies, including the ARDNROC. The ARDNROC administers, through delegation by the WQCC, all Water Quality Act regulations pertaining to surface and groundwater (except sewage not present in a combined waste stream). According to the ARDNROC, produced water if predictable in salt concentration, can be used for drilling and completion and possibly cementing.

3.8.1 Surface Water Resources

Surface water hydrology within the area is typically influenced by geology, soil characteristics, precipitation and vegetation. There are no water bodies on EOI #1552. The closest lake to this EOI is Paris Reservoir which is located over one mile north. There are two unnamed tributaries located within 0.5 mile of this EOI. Slover Creek is a tributary to Little Piney Creek and is located < 0.15 mile north of this EOI. Big Piney Creek is located one mile south.

Water resources may be affected by many activities including fire/prescribed burns, military use, mineral extraction, recreation, transportation, and vegetation management activities. The most likely effects to hydrology will be to stream channel morphology, and water quality. Channel alterations can be measured in specific morphological parameters. Water nutrients can be measured in concentration per unit volume.

The Arkansas River Valley Region exhibits distinct seasonal characteristics of its surface waters with zero flows common during summer critical conditions. Peak runoff events from within this region tend to introduce contaminants from the predominantly agricultural land use, which are primarily pasture lands with increasing poultry production. The development of natural gas has resulted in some site-specific water quality degradation. Soil types in much of this area are highly erosive and tend to easily go into colloidal suspension, thus causing long-lasting, high-turbidity values (ADEQ 2008).

3.8.2 Ground Water Resources

Groundwater hydrology within the areas is influence by geology and recharge rates. Groundwater quality and quantity can be influenced by precipitation, water supply wells, and various disposal activities. Most onshore produced water is injected deep underground for either enhanced recovery or disposal. With the passage of the Safe Drinking Water Act in 1974, the subsurface injection of fluids came under federal regulation. In 1980, the EPA promulgated the Underground Injection Control regulations. The program is designed to protect underground sources of drinking water.

Almost all of the surficial aquifers supply water of good to very good quality, ranging from calcium-bicarbonate to sodium-bicarbonate water types. Areas of poor water quality can result from both natural and anthropogenic sources. Natural sources of contamination are typically regional in extent and are related to water-rock interactions. Anthropogenic impacts include both point and nonpoint sources of contamination. Nonpoint sources can result in large areas of impact, although contaminant concentrations typically are significantly lower than point sources, and the contaminants typically represent soluble, non-reactive species. Point sources of contamination often result in elevated levels of contaminants that exceed federal maximum contaminant levels; however, the extent of contamination normally is confined to a small area, with little to no offsite migration or impact on receptors (ADEQ 2008).

The initial Arkansas Nonpoint Source Pollution Assessment (1988) assessed approximately 4,068 miles of stream and found that 58 percent of the assessed streams were not meeting all designated uses. Limited data for the 79 significant publicly owned lakes indicated no use impairment by nonpoint sources. The 1988 assessment identified agriculture and mining as the primary categories of nonpoint source pollution causing impairments to water bodies of the state (ADEQ 2008). The 1988 assessment was updated in June 1997, using updated assessment criteria. The 1997 report assessed 8,700 stream miles and indicated that nonpoint source pollution was impacting (but not necessarily impairing) more than 4,100 stream miles. Agricultural impacts were identified as the major cause of impacts on 3,197 stream miles. Other major impacts were related to silviculture activities, road construction/maintenance activities, and unknown sources. The unknown source was mercury contamination of fish tissue (ADEQ 2008).

3.8.3 Hydraulic Fracturing

Some studies have shown that anywhere from 20-85% of fracturing fluids may remain underground. Used fracturing fluids that return to the surface are often referred to as flowback. The resulting flowback and produced water will be contained until it is promptly removed and disposed of to an injection well, recycling facility, or disposal facility. Conditions of Approval (COAs) at the APD stage will require the operator and contractors to ensure that all use, production, storage, transportation and disposal of produced water associated with the drilling, completion and production of a well be in accordance with all applicable existing or hereafter promulgated federal, state and local government rules, regulations and guidelines.

3.9 Wetlands/Riparian Areas/Floodplains

Wetland habitats provide important wintering and migration habitat for several species of migratory birds. Wetlands also provide a link between land and water and are some of the most productive ecosystems in the world. EO 11990 on the Protection of Wetlands provides an opportunity for early review of federal agency plans regarding new construction in wetland areas. Under EO 11990, each agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating and licensing activities.

There are no water bodies on EOI #1552. The closest lake to this EOI is Paris Reservoir which is located over one mile north. There are two unnamed tributaries located within 0.5 mile of this EOI. Slover Creek is a tributary to Little Piney Creek and is located < 0.15 mile north of this EOI. Big Piney Creek is located one mile south.

3.10 Invasive/Exotic Species

Noxious weeds can have a disastrous impact on biodiversity and natural ecosystems. Noxious weeds affect native plant species by out-competing native vegetation for light, water and soil nutrients. Noxious weeds cause $2 to $3 million in estimated losses to producers annually. These losses are attributed to: 1) decreased quality of agricultural products due to high levels of competition from noxious weeds, 2) decreased quantity of agricultural products due to noxious weed infestations, and 3) costs to control and/or prevent the spread of noxious weeds.

There are a number of non-native species that are considered invasive in Arkansas. The Arkansas State Plant Board and the University of Arkansas Division of Agriculture have published a list of the top ten invasive species of concern in Arkansas, summarized in the table below. The potential applicability of these invasive species' habitat to the proposed tracts are also discussed below. While none of these species were observed while on the tracts, those tracts that have optimal or marginal habitat for the species are listed.

Table 2. List of top ten invasive species documented to occur in Arkansas by the Arkansas State Plant Board.

COMMON NAME	SCIENTIFIC NAME	DESCRIPTION	APPLICABILITY TO TRACT
Bacteria Leaf Streak of Rice (BLS)	*NA*	Disease affecting rice leafs. Symptoms include thin water soaked interveinal leaf streaks that enlarge, brown, and join together. Typically found in warm, wet, nitrogen rich environments. Hosts include *Leersia, Zizania, Paspalum, Leptochloa, and Zoysia.*	No rice crops identified on or near the tracts.
Channeled Apple Snail	*Pomacea canaliculata*	Snail poses threats to rice and wetland areas. Snails lay clusters of 200-300 pink colored eggs above water.	No suitable habitat on tracts.
Cogongrass	*Imperata Cylindrica*	Fast growing weed that outcompetes native plants. Found in fields and spread through rhizome fragments in soil, farming equipment, soil movement, etc.	No suitable habitat on tracts.
Hydrellia wirthi	*Hydrellia wirthi*	Small (about 5mm long) fly that attacks and stuns or kills rice seedlings.	No rice crops identified on or near tracts.
Hydrilla	*Hydrilla verticillata*	Aquatic weed first observed in Lake Ouachita. Found at or just below the water surface and may extent up to 30 feet deep.	No suitable water on the tracts.
Old World Bollworm	*Helicoverpa armigera*	Ornamental plants and flowers as well as crops can host this insect. Looks similar to corn earworm. Not yet detected in Arkansas but ongoing sampling is in effect.	No suitable habitat on tracts.
Rice Nematode	*Ditylenchus angustus*	Microscopic rice disease which distorts rice panicles causing panicle twisting and sterilization.	No rice crops identified on or near tracts.
Sirex Wood Wasp	*Sirex noctilio*	Wood wasps that threatens even-aged stands of pines or stressed pines. Has historically caused significant damage to Loblolly Pine.	Suitable habitat found on western-most tract of EOI #1552. No suitable habitat on other tract or EOI #1661.
Sudden Oak Death (SOD)	*(caused by) Phytophthora*	Fungus-like microorganism causing SOD disease. SOD symptoms include bleeding	Suitable habitat available on both EOIs.

	ramorum	cankers on lower trunk and leaf spots with dark margins. SOD eventually can lead to death of host. Hosts include numerous varieties of trees and woody ornamentals.	
Tropical Soda Apple	*Solanum viarum*	Perennial shrub with sharp bards and fruit resembling small watermelons. Declared a noxious weed in 2007. Found in fields, pastures, parks, and possibly open forests.	No suitable habitat on tracts.

Source: Top Ten Invasive Species. Arkansas State Plant Board & University of Arkansas Division of Agriculture. Available online at http://plantboard.arkansas.gov/PlantIndustry/Documents/InvasiveSpeciesGuide.pdf

No invasive species were observed during the site visits. However, invasive species are possible. If the leases are sold and issued and development subsequently is proposed, invasive species would be dealt with prior to initiating any surface disturbing activities to minimize further spread of the plants.

3.11 Special Status Species

3.11.1 Federally Listed Species

Section 7 of the ESA requires that federal agencies prevent or modify any projects authorized, funded, or carried out by the agencies that are "likely to jeopardize the continued existence of any endangered species or threatened species, or result in the destruction or adverse modification of critical habitat of such species." Tables 3 and 4 present the species listed by FWS as endangered, threatened, proposed, or candidate that are documented to occur in Logan County, Arkansas (EOI #1552) (Table 3) and Pope County (EOI #1661) (Table 4). The tables also present a summary of BLMs determination regarding anticipated effects on those species from development that might occur from the proposed leases. Specific information regarding habitat requirements and rationale for those determinations are provided below under each species section. Details regarding species habitat, habits, threats and other information has been obtained from the Nature Serve website (www.natureserve.org) and published literature.

3.11.1.1 EOI #1552

Table 3. Federally listed species documented by FWS to occur in Logan County, Arkansas.

Species	Federal Status	Determination	Rationale
Bald Eagle (*Haliaeetus leucocephalus*)	Delisted	No effect	No suitable habitat
Piping Plover (*Charadrius melodus*)	Threatened	No effect	No suitable habitat
Northern Long-eared Bat (*Myotis septentrionalis*)	Proposed Endangered	May affect, not likely to adversely affect	Potential suitable foraging habitat present
Interior Least Tern (*Sterna antillarum athalassos*)	Endangered	No effect	No suitable habitat
American Burying Beetle (*Nicrophorus americanus*)	Endangered	May affect, not likely to adversely affect	Potential suitable habitat present
Arkansas River Shiner (*Notropis girardi*)	Threatened	No effect	No suitable habitat
Ozark Big-eared Bat (*Corynorhinus townsendii*)	Endangered	May affect, not likely to adversely affect	Potential suitable foraging habitat present

3.11.1.1.1 Bald Eagle (*Haliaeetus leucocephalus*) (Delisted)

The bald eagle was delisted in 2007 due to recovery. A five year monitoring program has been established to ensure that bald eagle populations are stable, and that delisting continues to be appropriate for this species. Bald eagles will remain protected under the Bald and Golden Eagle Protection Act, as well as the Migratory Bird Treaty Act. Bald eagles are associated with large inland lakes, large rivers and coastal waters and use large old growth pine, bald cypress and some oak species, usually within ¼ mile of inland lakes and large rivers for nesting and loafing. Paris reservoir is located 2 miles northeast of EOI #1552 and could potentially contain suitable habitat for the bald eagle. However, EOI #1552 itself does not contain suitable habitat for this species because it is primarily cleared land and young pine plantations.

3.11.1.1.2 Piping Plover (*Charadrius melodus*) (Threatened)

The piping plover is a small, stocky, shorebird with a sand-colored upper body, white underside, and orange legs. They grow up to 7 inches long and weigh just 2.25 ounces. Their food consists of worms, fly larvae, beetles, crustaceans, mollusks, and other invertebrates. The piping plover is a migratory bird which often returns to the same nesting area in consecutive years. This species lives near ocean beaches or on sand or algal flats in protected bays. It is most abundant on expansive sandflats, sandy mudflats, and sandy beach in close proximity; usually in areas with high habitat heterogeneity.

Arkansas suitable breeding habitats are wide beaches (> 20 meters) with highly clumped vegetation, having less than 5 percent overall vegetation cover and/or with extensive gravel. There are no water bodies on the tract to support the piping plover.

3.11.1.1.3 Northern Long-eared Bat (*Myotis septentrionalis*) (Proposed Endangered)

The northern long-eared bat requires caves or mines to hibernate in during the winter. During the summer months, this species can be found roosting in caves, mines, or buildings, and under loose bark, bridges, or in hollow tree cavities. Research has shown that during the summer months, presence and activity of the northern long-eared bat is highest in forests with late successional characteristics. Late-successional forest characteristics that seem to be important to this species includes a high percentage of old trees (>100 years), uneven forest structure, single and multiple tree fall gaps, standing snags, and woody debris. These characteristics provide a high number of dead or decaying trees that can be used for breeding, summer day roosting, and foraging.

The habitat located on EOI #1552 is not ideal for the northern long-eared bat because it contains logged areas and young pine plantations. This species likely would not be found roosting on the parcel. However, there is a possibility that it could be found roosting on this parcel and could also use the parcel for foraging habitat. This species has been documented by the ANHC along Short Mountain Creek approximately 2 miles southeast of this EOI (Appendix C).

3.11.1.1.4 Interior Least Tern (*Sterna antillarum athalassos*) (Endangered)

The interior least tern is a migratory shorebird species which breeds, nests, and rears young on non-vegetated portions of sand bars and beaches along major rivers and reservoirs. Current FWS guidance recommends that no activity be conducted within 650′ of a nesting colony; and that construction activities within 650-ft. of a nesting colony be conducted outside of the nesting season (May 15 through August 31) to avoid adverse effects to the species. Paris reservoir is located 2 miles northeast of this parcel and could potentially contain suitable habitat for this species, however there is no suitable habitat on the tract.

3.11.1.1.5 American Burying Beetle (*Nicrophorus americanus*) (Endangered)

The American burying beetle is an important component of the decomposing loop of ecosystems because it feeds on carrion. This species has a broad range of habitat preferences and is primarily found in hardwood forests, grasslands, and old field shrubland. EOI #1552 potentially contains suitable habitat for this species. This species has been documented by the ANHC within five miles of this EOI (Appendix C).

3.11.1.1.6 Arkansas River Shiner (*Notropis girardi*) (Threatened)

The Arkansas river shiner can be found in turbid waters of broad, shallow, unshaded channels of creeks and small to large rivers, over mostly silt and shifiting sand bottoms. This species is thought to be extirpated in Arkansas. There are no water bodies on the tract.

3.11.1.1.7 Ozark Big-eared Bat (*Corynorhinus townsendii*) (Endangered)

The Ozark big-eared bat can primarily be found in caves typically in limestone karst regions dominated by mature hardwoods forests of hickory, beech, maple and hemlock. This species has a state rank of critically imperiled in Arkansas by the ANHC. There are no known caves near this EOI, however there is potential for suitable foraging habitat.

3.11.1.2 EOI #1661

Table 4. Federally listed species documented by FWS to occur in Pope County, Arkansas.

Species	Federal Status	Determination	Rationale
Bald Eagle (*Haliaeetus leucocephalus*)	Delisted	May affect, not likely to adversely affect	Suitable habitat present
Piping Plover (Charadrius melodus)	Threatened	No effect	No suitable habitat
Rabbitsfoot (*Quadrula cylindrica cylindrica*)	Threatened	EOI #1561 - No effect	EOI #1561 - No suitable habitat
Speckled Pocketbook (*Lampsilis streckeri*)	Threatened	EOI #1561 - No effect	EOI #1561 - No suitable habitat
Northern Long-eared Bat (*Myotis septentrionalis*)	Proposed Endangered	May affect, not likely to adversely affect	Suitable foraging habitat present
Interior Least Tern (*Sterna antillarum athalassos*)	Endangered	EOI #1561 - No effect	EOI #1561 - No suitable habitat
Gray Bat (*Myotis grisescens*)	Endangered	May affect, not likely to adversely affect	Suitable foraging habitat present

Snuffbox (*Epioblasma triquetra*)		EOI #1561 - No effect	EOI #1561 - No suitable habitat
Ozark Big-eared Bat (*Corynorhinus townsendii*)	Endangered	May affect, not likely to adversely affect	Suitable foraging habitat present
Yellowcheek Darter (*Etheostoma moorei*)	Endangered	EOI #1561 - No effect	EOI #1561 - No suitable habitat
Indiana Bat (*Myotis sodalis*)	Endangered	May affect, not likely to adversely affect	Suitable habitat present

3.11.1.2.1 Bald Eagle (*Haliaeetus leucocephalus*) (Delisted)

Habitat needs for the bald eagle are described above for EOI #1552. Big Piney Creek is located < 1 mile south of EOI #1561. Piney Bay is a lake created by damming Big Piney Creek and Little Piney Creek and is located ~2 miles southwest of EOI #1561. Both of these water bodies contain suitable habitat for the bald eagle. It is possible that the bald eagle is utilizing the area.

3.11.1.2.2 Piping Plover (*Charadrius melodus*) (Threatened)

Habitat preferences for the piping plover are outlined above for EOI #1552. There are no ocean beaches, sand, algal, or mud flats in close proximity to the proposed lease.

3.11.1.2.3 Rabbitsfoot (*Quadrula cylindrical cylindrical*) (Threatened)

The typical habitat for the rabbitsfoot is small to medium rivers with moderate to swift currents. In smaller streams it inhabits bars or gravel and cobble close to the fast current. It is found in medium to large rivers in sand and gravel. It has been found in depths up to 3 m. Despite their streamlined appearance, specimens are more often found fully exposed lying on their sides on top of the substrate. There are no rivers on EOI #1561.

3.11.1.2.4 Speckled Pocketbook (*Lampsilis streckeri*) (Endangered)

The speckled pocketbook is a medium-sized (reaching approximately 80 mm in length) fresh water mussel with a thin, dark-yellow or brown shell with chevron-like spots, and chain-like rays. Like other freshwater mussels, the speckled pocketbook feeds by filtering food particles from the water column. The specific food habits of the species are unknown, but other juvenile and adult freshwater mussels have been documented to feed on detritus, diatoms, phytoplankton, and zooplankton. The diet of speckled pocketbook glochidia, like other freshwater mussels, comprises water (until encysted on a fish host) and fish body fluids (once encysted). This species is typically found in coarse to muddy sand with a constant flow of water. The speckled pocketbook is not associated with slow current, pools, or stretches of rivers with intermittent flow.

Historically, populations occurred in Archey, Middle, and South Forks of the Little Red River in Van Buren County, Arkansas. This species has been found in recent years from the following streams in the Little Red River drainage: Archey, Beech, Middle, South, and Turkey Forks of the Little Red River, and Big Creek. There is no suitable habitat for this species on EOI #1561.

3.11.1.2.5 Northern Long-eared Bat (*Myotis septentrionalis)* (Proposed Endangered)

Habitat preferences for the northern long-eared bat are described above for EOI #1552. There is suitable foraging and roosting habitat on EOI #1661 for this species.

3.11.1.2.6 Interior Least Tern (*Sterna antillarum athalassos*) (Endangered)

Habitat needs for the interior least tern are described above. There are no large reservoirs or rivers on EOI #1561, therefore suitable habitat for this species is not present.

3.11.1.2.7 Gray Bat (*Myotis grisescens*) (Endangered)

The gray bat occurs mainly in the karst region of the eastern and central U.S. and is highly vulnerable to disturbance. Only a few caves contain most of the individuals. As a result of ongoing cave protection efforts, the total population is increasing. Each summer a colony occupies a traditional home range that often contains several roosting caves scattered along as much as 70 kilometers of river or reservoir borders. Individuals forage along rivers or shoreline up to 20 km from their roosts. Forested areas along the banks of streams and lakes provide important protection for adults and young. Young often feed and take shelter in forest areas near the entrance to cave roosts. This species does not feed in areas along rivers or reservoirs where the forest has been cleared. No caves are located on the proposed site and no known caves are located in the immediate surrounding area. The gray bat is unlikely to roost on the proposed tract as there is no suitable habitat. However, the proposed site does provide suitable foraging habitat for the gray bat.

3.11.1.2.8 Snuffbox (*Epioblasma triquetra*) (Endangered)

Snuffbox is a small mussel federally listed as endangered. In Arkansas, it is known from two localities within the White River, a few sites in the Spring River and Strawberry River, and a single dead specimen from the Black River at the Spring River mouth. Pollution through point and non-point sources is perhaps the greatest on-going threat to this species and most freshwater mussels. This species can be found in riffles of medium and large rivers with stony or sandy bottoms, in swift currents, usually deeply buried. There is no suitable habitat for this species on EOI #1561.

3.11.1.2.9 Ozark Big-eared Bat (*Corynorhinus townsendii*) (Endangered)

Habitat preferences for the Ozark big-eared bat have been described above. There are no documented caves on or within the vicinity of the proposed parcel, however there is suitable foraging habitat.

3.11.1.2.10 Yellowcheek darter (*Etheostoma moorei*) (Endangered)

The yellowcheek darter (*Etheostoma moorei*) is a small and compressed fish which attains a maximum standard length of about 64 mm (2.5 inches), has a moderately sharp snout, deep body, and deep caudal peduncle. The back and sides are grayish brown, often with darker brown

saddles and lateral bars. Breeding males are brightly colored with a bright blue or brilliant turquoise breast and throat and light green belly, while breeding females possess orange and red-orange spots but are not brightly colored. First collected in 1959 from the Devils Fork tributary of the Little Red River, this species was eventually described by Raney and Suttkus in 1964, using 228 specimens from the Middle Fork, South Fork, and Devils Fork tributaries of the Little Red River. The yellowcheek darter is one of only two members of the subgenus *Nothonotus* known to occur west of the Mississippi River. The South Fork of the Little Red River is designated Critical Habitat for the yellowcheek darter. The Little Red River is located >30 miles east of the proposed project. EOI #1561 does not contain suitable habitat for this species.

3.11.1.2.11 Indiana Bat (*Myotis sodalis*) (Endangered)

In the winter, the Indiana bat hibernates in caves. In the summer, habitat consists of wooded or semiwooded areas, often but not always along streams. Maternity sites generally are behind loose bark of dead or dying trees or in tree cavities. Foraging habitats include riparian areas, upland forests, ponds, and fields, but forested landscapes are the most important habitat in agricultural landscapes. Known roost tree species include elm, oak, beech, hickory, maple, ash, sassafras, birch, sycamore, pine, and hemlock, especially trees with exfoliating bark.

Suitable summer and foraging habitat is available on EOI #1661 for this species.

3.12 Vegetation and Wildlife

3.12.1 Vegetation

Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. A Roman numeral hierarchical scheme has been adopted for different levels of ecological regions. Level I is the coarsest level, dividing North America into 15 ecological regions. Level II divides the continent into 52 regions. At level III, the continental U.S. contains 104 regions whereas the conterminous U.S. has 48. Level IV ecoregions are further subdivisions of level III ecoregions. Six level III ecoregions can be found in Arkansas. EOI #1552 is located in Logan County and EOI #1561 are located in Pope County in northwest Arkansas in the Arkansas Valley Ecoregion. The Arkansas Valley Ecoregion is composed of plains, hillsides, floodplains, terraces and scattered mountains (Anderson 2006). Prior to the 19th century, uplands were dominated by forested areas, woodlands, savannas and prairie land and floodplains and lower terraces were dominated by bottomland hardwood forests (Anderson 2006). Currently, many upland areas have been cleared for pasture or hayland with poultry and livestock farming also prevalent.

3.1.1 EOI #1552

This 100 acre tract is located in Logan County and consists of 2 parcels separated by ~2 miles (Appendix A). The west parcel consists of ~80 acres with Highway 109 running east/west diagonally through the center of the tract (Appendix A). A gravel road is located along the western and southern boundaries. A power line runs east/west through the northern quarter of the tract. The parcel consists of loblolly pine (*Pinus taeda*) plantations and logged areas. Logging of

portions of the tract was occurring while the site visit was being conducted on April 23, 2014. Pine trees ranged in size from 5 -20 feet. The surrounding area within a two mile buffer is primarily cleared land to the west and east and primarily forested to the north. Lands south of the tract is partly cleared and partly forested. The second parcel is located <2 miles east and consists of ~20 acres. County roads are located just outside portions of the southwest and southeast boundaries. A gas line runs north/south through the western quarter of the tract (Appendix A). A dirt road runs from the southwest to northwest corners. The parcel consists of pine-mixed hardwood forest. Dominant tree species include: loblolly pine, short leaf pine (*P. echinata*), laurel oak (*Quercus laurifolia*), wax myrtle (*Ilex vomitoria*), post oak (*Q. stellata*), and Eastern red cedar (*Juniperus virginiana*). The surrounding area within a two mile buffer contains some cleared areas for agriculture and timber and some forested areas.

3.1.2 EOI #1561

EOI #1561 consists of 39.86 acres in Pope County ~10 miles east of Clarksville (Appendix A). An electrical power line runs north/south in the western quarter of the tract. This parcel consists of a pine-mixed hardwood forest with the following dominant tree species: Eastern red cedar, shortleaf pine (*P.echinata*), slash pine (*P. elliotti*), white oak (*Quercus. alba*), mockernut hickory (*Carya tomentosa*), post oak (*Q. stellata*), overcup oak (*Q. lyrata*), and flowering dogwood (*Cornus florida*). Within a two mile buffer surrounding the parcel, lands to the south are primarily forested and land to the north is primarily cleared for cattle pastures and hayland. Acreages to the east and west are a mix of cleared and forested land. Big Piney Creek is located <1 mile south of the tract.

3.12.2 Wildlife

Wildlife diversity and abundance is likely high on the proposed parcels. Wildlife population levels have changed tremendously over time. For example, many current game species have increased through careful management and habitat manipulation. Deer and turkey populations, formerly low due to unregulated hunting, have increased through reintroduction, management, and increased protection. Other species, like the red-cockaded woodpecker, northern bobwhite quail, and Bachman's sparrow have declined due to past timber harvest methods and the infrequency of large-scale wildlfires.

Hunting is a popular pastime in Arkansas and game species populations are high enough to support this activity. Major game on non-developed areas of Arkansas includes white-tailed deer, wild turkey, fox, gray squirrel, bobwhite quail, woodcock, waterfowl, and the morning dove.

3.13 Migratory Bird Species of Concern

EO 13188, 66 Fed. Reg. 3853, (January 17, 2001) identifies the responsibility of federal agencies to protect migratory birds and their habitats, and directs executive departments and agencies to undertake actions that will further implement the Migratory Bird Treaty Act (MBTA). Under the MBTA, incidental, unintentional, and accidental take, killing, or possession of a migratory bird or its parts, nests, eggs or products, manufactured or not, without a permit is unlawful. EO 13186 includes a directive for federal agencies to develop a Memorandum of Understanding (MOU)

with the FWS to promote the conservation of migratory bird populations, including their habitats, when their actions have, or are likely to have, a measureable negative effect on migratory bird populations.

For the purpose of this analysis, the term "migratory birds" applies generally to native bird species protected by the MBTA. This includes native passerines (flycatchers and songbirds) as well as birds of prey, migratory waterbirds (waterfowl, wading birds, and shorebirds), and other species such as doves, hummingbirds, swifts, and woodpeckers. The term "migratory" is a misnomer and should be interpreted broadly to include native species that remain in the same area throughout the year as well as species that exhibit patterns of latitudinal or elevational migration to avoid winter conditions of cold or shortage of food. For most migrant and native resident species, nesting habitat is of special importance because it is critical for supporting reproduction in terms of both nesting sites and food. Also, because birds are generally territorial during the nesting season, their ability to access and utilize sufficient food is limited by the quality of the territory occupied. During non-breeding seasons, birds are generally non-territorial and able to feed across a larger area and wider range of habitats.

Among the wide variety of species protected by the MBTA, special concern is usually given to the following groups:

- Species that migrate across long distances, particularly Neotropical migrant passerines that winter in tropical or Southern Hemisphere temperate zones
- Birds of prey, which require large areas of suitable habitat for finding sufficient prey
- Species that have narrow habitat tolerances and hence are vulnerable to extirpation from an area as a result of a relatively minor habitat loss
- Species that nest colonially and hence are vulnerable to extirpation from an area as a result of minor habitat loss

Because of the many species that fall within one or more of these groups, BLM focuses on species identified by FWS as Birds of Conservation Concern (BCC) (USDI 2002). Table 4 lists the BCC found in the West Gulf Coastal Plain/Ouachitas Bird Conservation Region, where the lease parcels are located.

Table 4. List of BCC found in the West Gulf Coastal Plain/Ouachitas Bird Conservation Region.

Common Name	**Scientific Name**
American Kestrel (*paulus* ssp.)	*Falco sparverius paulus*
Bachman's Sparrow	*Aimophila aesivalis*
Bald Eagle (b)	*Haliaeetus leucocephalus*
Bewick's Wren (*bewickii* ssp.)	*Thryomanes bewickii bewickkii*
Brown-headed Nuthatch	*Sitta pusilla*
Buff-breasted Sandpiper (nb)	*Tryngites subruficollis*
Cerulean Warbler	*Dendroica cerulea*

Chuck-will's-widow	*Caprimulgus carolinensis*
Henslow's Sparrow	*Ammodramus henslowii*
Hudsonian Godwit	*Limosa haemastica*
Kentucky Warbler	*Oporornis formosus*
Least Bittern	*Ixobrychus exilis*
Little Blue Heron	*Egretta caerulea*
Loggerhead Shrike	*Lanius ludovicianus*
Louisiana Waterthrush	*Seiurus motacilla*
Orchard Oriole	*Icterus spurius*
Painted Bunting	*Passerina ciris*
Prairie Warbler	*Dendroica discolor*
Prothonotary Warbler	*Protonotaria citrea*
Red-headed Woodpecker	*Melanerpes eryhrocephalus*
Solitary Sandpiper (nb)	*Tringa solitaria*
Sprague's Pipit	*Anthus spragueii*
Swainson's Warbler	*Limnothlypis swainsonii*
Swallow-tailed Kite	*Elanoides forficatus*
Wood Thrush	*Hylocichla mustelina*
Worm-eating Warbler	*Helmitheros vermivorus*
Yellow Rail (nb)	*Coturnicops noveboracensis*

Note: (a) - ESA candidate, (b) - ESA delisted, (c) - non-listed subspecies or population of threatened or endangered species, (nb) - non-breeding in this Bird Conservation Region

There is suitable habitat on the proposed lease parcels for several BCC on this list.

Ch. 4 - ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

4.0 Introduction

This chapter assesses potential environmental consequences associated with direct, indirect, and cumulative effects of the Proposed Action. The act of leasing parcels would, by itself, have no impact on any resources in the lease area. All impacts would be linked to as yet undetermined future levels of lease development. If these parcels were developed, short-term impacts are considered those that would be stabilized or mitigated within five years and long-term impacts are those that would substantially remain for more than five years. Cumulative impacts include the combined effect of past projects, specific planned projects and other reasonably foreseeable future actions such as other infield wells being located within these leases. The cumulative impacts fluctuate with the gradual reclamation of well abandonments and the creation of new additional surface disturbances from the construction of new access roads and well pads. The on-going process of restoration of abandonments and creating new disturbances for drilling new wells gradually accumulates as the minerals are extracted from the land. Preserving as much land as possible and applying appropriate mitigation measures will alleviate the cumulative impacts. Cumulative impacts are addressed for each resource within each resource section.

Based on review of elements of the environment and consideration of the Purpose and Need statement prepared for this EA, the following elements will be addressed: Environmental Justice, Cultural Resources and Native American Concerns, Minerals and Mineral Development, Wastes, Soils, Air Resources, Water Resources - Surface/Ground, Wetlands/Riparian Areas/Floodplains, Invasive/Exotic Species, Special Status Species, Vegetation and Wildlife, and Migratory Birds of Concern.

4.1 Environmental Justice

No minority or low income populations would be directly or disproportionately affected in the vicinity of the lease parcels from the proposed leases or possible subsequent development. The proposed leases would not create an unsafe or unhealthy environment for any population, including minority and low-income populations and therefore will not be out of conformance with EO 12898. Indirect impacts from possible future development could include an increase in overall employment opportunities related to the oil and gas and service support industry in the region, as well as the economic benefits to state and parish governments related to royalty payments and severance taxes. Other potential impacts include a short-term increase in traffic volume and dust and noise which could negatively impact nearby residents or businesses. These nuisance impacts are usually limited to the construction, drilling, and/or completion phases and would be significantly reduced during production, when the site would be visited periodically for inspection and/or to haul produced fluids. These impacts would apply to all land users in the area. There are no cumulative impacts anticipated for environmental justice from issuing the lease.

4.2 Cultural Resources and Native American Concerns

Cultural resource surveys have not been conducted, therefore direct and indirect impacts may occur to cultural resources or to a potentially sacred Native American religious site if there is ground disturbance. Direct impacts are those such as completely destroying a site by bulldozing the area and workers picking up artifacts. Indirect impacts are those such as erosion or compaction of the soil on the site. However, if sites are located and recorded before ground disturbance begins, these impacts can be avoided or mitigated.

Cumulative effects from repetitious illegal activity, primarily archeological vandalism, may occur on certain sites or site types unless perpetrators are apprehended and prosecuted. The degree of cumulative effects to known properties from BLM activities should be slight as inventory, assessment, protection, and mitigation measures would be implemented at the APD stage.

A stipulation regarding cultural resources and Native American religious concerns applies to this lease (Appendix B) and is applicable for all the proposed parcels. The stipulation states that the BLM will not approve any ground disturbing activities that may affect historic properties and/or resources until it completes its obligations under applicable requirements of the National Historic Preservation Act and other authorities. If currently unknown burial sites are discovered during development activities associated with this lease, these activities must cease immediately, applicable law on unknown burials will be followed and, if necessary, consultation with the appropriate tribe/group of federally recognized Native Americans will take place.

Consultation with the SHPO occurred on January 5, 2012, (EOI #1552) and January 13, 2014 (EOI #1561). Concurrence letters were received on February 12, 2012 (EOI #1552) and March 10, 2014 (EOI #1561) (Appendix C). Letters were sent to various tribes on January 5, 2012 (EOi #1552) and January 13, 2014 (EOI #1562) notifying them of the proposed action and requesting comments or concerns. Comments were received from tribes on January 25, 2012 and February 13, 2012 for EOI #1552 and February 19, 2014 (EOI #1561).

4.2.1 Mitigation

A BLM stipulation regarding cultural resources and Native American religious concerns applies to these lease parcels (Appendix B). The stipulation states that the BLM would not approve any ground disturbing activities that may affect historic properties and/or resources until it completes its obligations under applicable requirements of the NHPA and other authorities. If currently unknown burials are discovered during development activities associated with this lease, these activities must cease immediately, applicable law on unknown burials will be followed and, if necessary, consultation with the appropriate Tribe/group of federally recognized Native Americans will take place.

4.3 Visual/Noise Resources

4.3.1 Visual

While the act of leasing federal minerals would produce no impacts to visual resources, subsequent exploration/development of the proposed leases could impact visual quality through: increased visibility of constructed features such as roads, well pads, pipelines, and tank batteries; road degeneration from heavy trucks and vehicles following rain; dust and exhaust from construction, drilling, and production vehicles and equipment; vegetation removal and construction of steep slopes; unreclaimed sites; and discarded equipment. Well pads, power lines, access roads, and associated production facilities and storage tanks have the greatest potential to alter visual conditions for the life of the well. Vegetation removal would present an obvious contrast in color with the surrounding vegetation and affect foreground and middleground distance zones for more than a decade. These impacts would be most obvious immediately after construction. Impacts would decrease as the disturbed surface began to blend in color, form, and texture, when interim or final reclamation occurs. Long-term visual impacts could persist as long as the well is producing, which could be a couple of years to more than 50 years. Long-term impacts may include vegetation removal, alteration of the landscape, and installation of equipment and facilities. The extent of cumulative effects on visual resources will depend on the future amount of oil and gas development in southwest Arkansas. Oil and gas productivity has been high in this area and it is likely that continued development will also be high. Additional roads, wells pads and other constructed features due to oil and gas development will have a negative cumulative effect on visual resources. As well pads get reclaimed however, this impact should diminish.

4.3.2 Noise

Noise generation from well operations would be associated with vehicle movements and the operation of production equipment. Increased traffic to well sites will have a short-term impact on noise levels. After drilling operations are completed, minimal traffic for maintenance will be associated with the proposed wells. Impacts from noise on people and wildlife species inhabiting the areas are expected to be minimal and of occasional and short duration for the proposed parcels. The extent of cumulative impacts to noise in the area surrounding the proposed parcels will depend on the future amount of oil and gas development in the area. Productivity has been high in this area and development is likely to increase which would increase noise levels. An increase in noise levels should be periodic and only occur during drilling operations.

4.4 Minerals and Mineral Development

While the act of leasing federal minerals would produce no impacts to mineral resources, subsequent exploration/development of the proposed leases could impact the production horizons and reservoir pressures. If production wells are established, the resources allotted to the wells would eventually be depleted. The amount and location of direct and indirect effects cannot be predicted until site-specific development information is available, typically during the APD stage.

Other mineral resources could be impacted as a result of exploration/development through the loss of available surface or subsurface area needed to develop or access the other mineral resource overlapping the subject lease parcels. The extent of the impacts (direct, indirect, or cumulative), if any, cannot be predicted until site-specific development information is available at the APD stage.

4.5 Wastes

While the act of leasing federal minerals would produce no wastes, subsequent exploration/development of the proposed leases could result in the introduction of hazardous and non-hazardous substances to the site. Hazardous substances may be produced, used, stored, transported or disposed of as a result of development on the proposed leases. Projects would typically generate the following wastes: (1) discharge of drilling fluids and cuttings into the reserve pits, (2) wastes generated from used lubrication oils, hydraulic fluids, and other fluids used during production of oil and gas, some of which may be characteristic or listed hazardous waste, and (3) service company wastes from exploration and production activities as well as containment of some general trash. Certain wastes unique to the exploration, development, and production of crude oil and natural gas have been exempted from Federal Regulations as hazardous waste under Subtitle C of the RCRA of 1976. The exempt waste must be intrinsic to exploration, development or production activities and cannot be generated as part of a transportation or manufacturing operation. The drilling fluids, drill cuttings, and produced waters are classified as a RCRA exempt waste, and potential drilling that could occur would not introduce hazardous substances into the environment if they are managed and disposed of properly under federal, state, and local waste management regulations and guidelines. Properly used, stored, and disposed of hazardous and non-hazardous substances greatly decreases the potential for any impact on any environmental resources. One way operators and the BLM ensure hazardous and non-hazardous substances are properly managed is through the preparation of a Spill Prevention, Control, and Countermeasure (SPCC) plan.

In hydraulic fracturing, chemical substances other than water make up a small percentage of the fluid composition; however, the very large volumes used require correspondingly large volumes of a variety of compounds. These substances range from the relatively benign to the highly toxic at certain concentrations. In addition to these added chemicals, naturally occurring toxicants such as heavy metals, VOCs, and radioactive compounds are mobilized during extraction and return to the surface with the produced water. Of the millions of gallons of water used to hydraulically fracture a well one time, less than 30% to more than 70% may remain underground (Bamberger and Oswald 2012). Although the risk is low, the potential exists for unplanned releases that could have serious effects on human health and environment. A number of chemical additives are used that could be hazardous, but are safe when properly handled according to requirements and long-standing industry practices. In addition, many of these additives are common chemicals which people regularly encounter in everyday life (GWPC 2009).

Surface spills of drilling mud and additives, hydraulic fracturing fluids and additives, flowback water, and other formation fluids can happen at a variety of points in the development and production phases. Spills that occur can span a range of different spill sizes and causes of failure at any point in the process. For example, small spills often happen as the result of poor pipe

connections or leaks; large spills sometimes occur as the result of a major well blowout, but such blowouts rarely occur. Additionally, spills from some parts of the phases may be the result of human error (i.e. vehicle collisions, improper handling, improper equipment operation or installation, etc.), while others stem from equipment failure (i.e. broken pipes, torn pit liners, leading tanks, etc.) or acts of nature (Fletcher 2012). The most common cause of spills comes from equipment failure and corrosion (Wenzel 2012).

The cause of the spill, the spill size, the hazard rating of the spilled material, response time to clean up the spill and the effectiveness of the cleanup, all play a critical role in determining the overall impact on the environment. The volume of a spill can significantly vary with spill types. Pipe spills are not expected to release more than 1,000 gallons into the environment, retaining pit spills and truck spills are not expected to release more than 10,000 gallons of fluid, and blowouts are expected to cause the largest spills, with the potential to release tens of thousands of gallons into the environment. Small spills occur with greater frequency than large spills. Secondary containment or recovery for small spills would likely minimize, if not eliminate, any potential release into the environment. However, for spills on the order of several thousands of gallons of fluid, it is expected that less than half the fluid may be captured by secondary containment or recovery. The vast majority of operations do not incur reportable spills (5 gallons or more), indicating that the fluid management process can be, and usually is, managed safely and effectively (Fletcher 2012). Cumulative effects from wastes are not anticipated. There are several BLM standard COAs that will apply at the APD stage which would reduce waste hazards.

4.5.1 Mitigation

Specific mitigation is deferred to the APD process. However, the following measures are common to most projects: all trash would be placed in a portable trash cage and hauled to an approved landfill, with no burial or burning of trash permitted, chemical toilets would be provided for human waste, fresh water zones encountered during drilling operations would be isolated by using casing and cementing procedures, a berm or dike would enclose all production facilities if a well is productive, and all waste from all waste streams on site would be removed to an approved disposal site. Future development activities on these lease parcels would be regulated under the RCRA, Subtitle C regulations. Additionally, waste management requirements are included in the 12 point surface use plan and the 9 point drilling plan required for all APDs. Leaseholders proposing development would be required to have approved SPCCPs, if the applicable requirements of 40 CFR 112 are met, and comply with all requirements for reporting of undesirable events. Lease bonds would not be released until all facilities have been removed, wells are plugged, and satisfactory reclamation has occurred.

There are 5 standard BLM COAs that would apply at the APD stage regarding handling and disposing of wastes. These COAs include: storing wastes properly to minimize the potential for spills, providing secondary containment for all stored containers, draining the reserve pit before closure and trucked to a disposal site, use of preventative measures to avoid drainage of fluids, sediments, and other contaminants from the pad into water bodies, and keeping the project area clear of trash (Appendix B).

Further, if shallow groundwater is expected or encountered at the project specific site, open reserve pits would not be authorized and all waste products would be hauled from the site to state-approved disposal facilities.

4.6 Soils

While the act of leasing federal minerals would produce no impacts to soils, subsequent exploration/development of the subject leases may produce impacts by physically disturbing the topsoil and exposing the substratum soil on subsequent project areas. Direct impacts resulting from oil and gas construction of well pads, access roads, and reserve pits include: removal of vegetation, exposure of the soil, mixing of horizons, compaction, loss of topsoil productivity and susceptibility to wind and water erosion. Wind erosion would be expected to be a minor contributor to soil erosion with the possible exception of dust from vehicle traffic during all phases of development. Vehicle traffic related wind erosion would be limited to approved travel routes in which the surface has not been paved or dressed in a material to prevent soil movement. The extent of wind erosion related to vehicle traffic will be dependent on a number of factors including: length of well bore, whether hydraulic fracturing is used during completion, whether telemetry is used during production, and whether the well is gas, oil, condensate, or a combination thereof. These impacts could result in increased indirect impacts such as runoff, erosion and off-site sedimentation. Activities that could cause these types of indirect impacts include construction and operation on well sites, access roads, gas pipelines and facilities.

Additional soil impacts associated with lease development would occur when heavy precipitation causes water erosion damage. When water saturated segment(s) on the access road become impassable, vehicles may still be driven over the road. Consequently, deep tire ruts would develop. Where impassable segments are created from deep rutting, unauthorized driving may occur outside the designated route of access roads.

Contamination of soil from drilling, hydraulic fracturing, and production wastes mixed into soil or spilled on the soil surface could cause a long-term reduction in site productivity. Contaminants spilled on soil would have the potential to pollute and/or change the soil chemistry. See the Waste Section (4.4) for a more in-depth analysis of spill contamination. Cumulative impacts could include loss of soil productivity, erosion and sedimentation issues, and road damage due to the direct and indirect impacts discussed above. These direct, indirect, and cumulative impacts can be reduced or avoided through proper design, construction, maintenance and implementation of Best Management Practices (BMPs) and COAs.

4.6.1 Mitigation

The operator would stockpile the topsoil from the surface of well pads which would be used for surface reclamation of the well pads. During the life of the development, all disturbed areas not needed for active support of production operations should undergo "interim" reclamation in order to minimize the environmental impacts of development on other resources and used. Upon abandonment of wells and/or when access roads are no longer in service, final reclamation would be implemented.

The impact to the soil would be remedied upon reclamation of well pads when the stockpiled soil that was specifically conserved to establish a seed bed is spread over well pads and vegetation re-establishes. A permanent vegetation cover would be established on all disturbed areas. Road construction requirements and regular maintenance would alleviate potential impacts to access roads from water erosion damage.

Fluid impermeable containment systems (i.e. liners, dikes, berms) would be placed in, under and/or around any tank, pit, drilling cellar, ditches associated with the drilling process, or other equipment that use or has the potential to leak/spill hazardous and non-hazardous fluids, to completely prevent solid contamination (e.g. liners) at the site or prevent the spill from going beyond the immediate site (e.g. dikes, berms).

A standard BLM COA would apply at the APD stage which would require the operator to take necessary measures to ensure that the final graded slopes are stabilized to prevent the movement of soil from the pad area for the life of the project. Stabilization techniques could include: natural, organic matting, silt fences, and or additional mulching.

4.7 Air Resources

4.7.1 Air Quality

The administrative act of offering the proposed lease parcels would have no direct impacts to air quality. Any potential effects to air quality would occur if and when the leases were developed. Any proposed development project would be subject to additional analysis of possible air effects before approval. The analysis may include air quality modeling for the activity.

An MOU between the Departments of the Interior and Agriculture and EPA directs that air quality modeling be conducted for actions that meet certain emissions or geographic criteria:

- Creation of a substantial increase in emissions
- Material contribution to potential adverse cumulative air quality impacts
- Class I or sensitive Class II Areas
- Non-attainment or maintenance area
- Area expected to exceed NAAQS or PSD increment

The project area includes no Class I, sensitive Class II, or non-attainment areas. Due to the small number of wells projected to follow a lease on the lease tracts in relation to the current volume of hydrocarbon, development of the lease is not likely to exceed the emissions criteria, NAAQS or PSD increment.

The following source of emissions are anticipated during any oil and gas exploration or development: combustion engines (i.e. fossil fuel fired internal combustion engines used to

supply electrical or hydraulic power for hydraulic fracturing to drive the pumps and rigs used to drill the well, drill out the hydraulic stage plugs and run the production tubing in the well; generators to power drill rigs, pumps, and other equipment; compressors used to increase the pressure of the oil or gas for transport and use; and tailpipe emissions from vehicles transporting equipment to the site), venting (i.e. fuel storage tanks vents and pressure control equipment), mobile emissions (i.e. vehicles bringing equipment, personnel, or supplies to the location) and fugitive sources (i.e. pneumatic valves, tank leaks, and dust). A number of pollutants associated with combustion of fossil fuels are anticipated to be released during drilling including: CO, NOx, SO_2, Pb, PM, CO_2, CH_4, and N_2O. Venting may release VOC/HAP, H_2S, and CH_4. Mobile source emissions are likely to include fugitive particulate matter from dust or inordinate idling.

The actual emissions of each pollutant will be entirely dependent on the factors described in the previous paragraph. During the completion phase, the most significant emissions of criteria pollutants emitted by oil and gas operations in general are VOCs, particulate matter and NO_2. VOCs and NOx contribute to the formation of O_3. The EPA's Natural Gas STAR Program is a voluntary program that identifies sources of fugitive CH_4 and seeks to minimize fugitive CH_4 through careful tuning of existing equipment and technology upgrades. Data provided by STAR show that some of the largest air emissions in the natural gas industry occur as natural gas wells that have been fractured and are being prepared for production. During well completion, flowback, fracturing fluids, water, and reservoir gas come to the surface at high velocity and volume. This mixture includes a high volume of VOCs and CH_4, along with air toxins such as benzene, ethylbenzene, and n-hexane. The typical flowback process lasts from 3 to 10 days. Pollution also is emitted from other processes and equipment during production and transportation of the oil and gas from the well to a processing facility.

To reasonably quantify emissions associated with well exploration and production activities, certain types of information are needed. Such information includes a combination of activity data such as:

- The number, type, and duration of equipment needed to construct/reclaim, drill and complete (e.g. belly scrapers, rig, completions, supply trucks, compressor, and production facilities)

- The technologies which may be employed by a given company for drilling any new wells to reduce emissions (e.g. urea towers on diesel powered drill rigs, green completions, and multi-stage flares)

- Area of disturbance for each type of activity (e.g. roads, pads, pipelines, electrical lines, and compressor station)

- Compression per well (sales and field booster), or average horsepower for each type of compressor

- The number and type of facilities utilized for production

The degree of impact will also vary according to the characteristics of the geological formations from which production occurs. Currently, it is not feasible to directly quantify emissions. What can be said is that emissions associated with oil and gas exploration and production would incrementally contribute to increases in air quality emissions into the atmosphere.

Air pollution can affect public health in many ways. Numerous scientific studies have linked air pollution to a variety of health problems including: (1) aggravation of respiratory and cardiovascular disease, (2) decreased lung function, (3) increased frequency and severity of respiratory symptoms such as difficulty breathing and coughing, (4) increased susceptibility to respiratory infections, (5) effects on the nervous system, including the brain, such as IQ loss and impacts on learning, memory, and behavior, (6) cancer, and (7) premature death. Some sensitive individuals appear to be at greater risk for air pollution-related health effects, for example, those with pre-existing heart and lung diseases (e.g., heart failure/ischemic heart disease, asthma, emphysema, and chronic bronchitis), diabetics, older adults, and children.

Significant degradation of air quality may also damage ecosystem resources. For example, ozone can damage vegetation, adversely impacting the growth of plants and trees. These impacts can reduce the ability of plants to uptake CO_2 from the atmosphere and can then indirectly affect the larger ecosystems.

Cumulative effects from potential oil and gas development from the proposed leases and possible future development could be an overall increase in CO, NOx, SO_2, Pb, PM, CO_2, CH_4, and N_2O. However, according to EPA's Air Trends report for 2011 (EPA 2011), since 1990, nationwide air quality has improved significantly for the six common air pollutants (Figure 4). These six pollutants are ground-level O_3, $PM_{2.5}$, PM_{10}, Pb, NO_2, CO, and SO_2. Nationally, air pollution was lower in 2010 than in 1990 for:

- 8-hour O_3, by 17%
- 24-hour PM_{10} , by 38%
- 3-month average Pb, by 83%
- annual NO_2 , by 45%
- 8-hour CO, by 73%
- annual SO_2 , by 75%

Nationally, annual $PM_{2.5}$ concentrations were 24% lower in 2010 compared to 2001 and 24-hour $PM_{2.5}$ concentrations were 28% lower in 2010 compared to 2001. O_3 levels did not improve in much of the East until 2002, after which there was a significant decline. Eight-hour O_3 concentrations were 13% lower in 2010 than in 2001. This decline is largely due to reductions in NOx required by EPA rules including the NOx State Implementation Plan (SIP) Call, preliminary implementation of the Clean Air Interstate Rule (CAIR), and Tier 2 Light Duty Vehicle Emissions Standards.

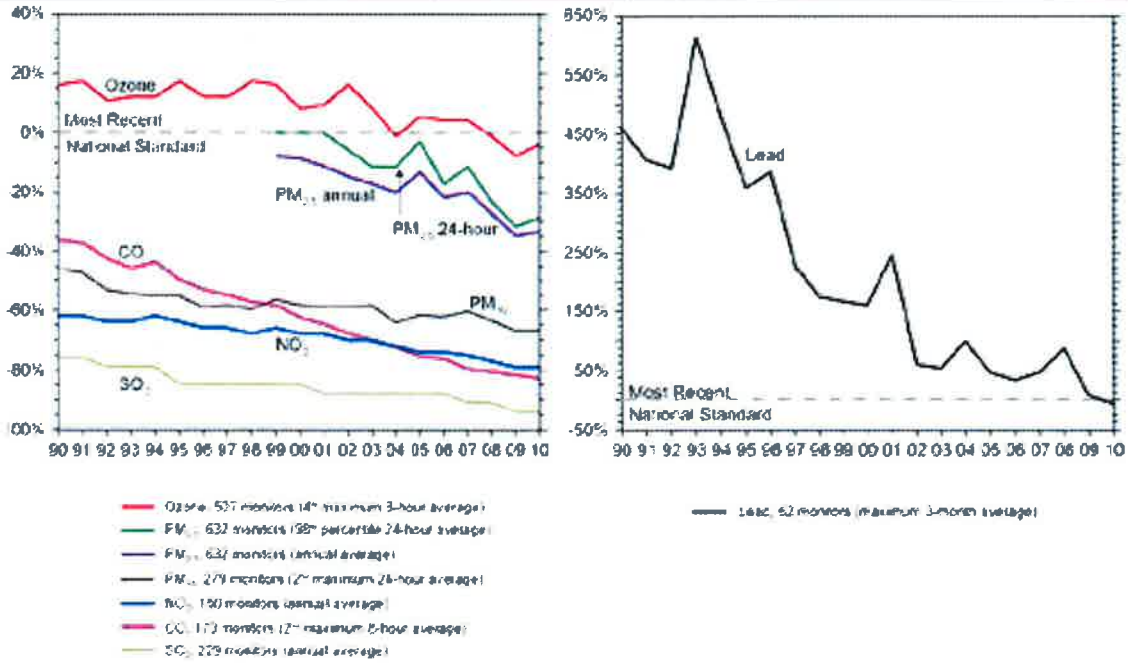

Figure 4. Comparison of national levels of the six common pollutants to the most recent NAAQS, 1990-2010. National levels are averages across all monitor stations with complete data for the time period. Note: Air quality data for $PM_{2.5}$ starts in 1999 (EPA, 2011).

EPA concludes that total emissions of toxic air pollutants have decreased by approximately 42% between 1990 and 2005. Control programs for mobile sources and facilities such as chemical plants, dry cleaners, coke ovens, and incinerators are primarily responsible for these reductions. They also found that monitored concentrations of toxic pollutants such as benzene, 1,3-butadiene, ethylbenzene, and toluene decreased by 5% or more per year between 2003 and 2010 at more than half of ambient monitoring sites. Other toxic air pollutants of concern to public health such as carbon tetrachloride, formaldehyde, and several metals, declined at most sites.

4.7.1.1 Mitigation

The BLM encourages industry to incorporate and implement BMPs, which are designed to reduce impacts to air quality by reducing emissions, surface disturbances, and dust from field production and operations. Typical measures include:

- Flared hydrocarbon gases at high temperatures in order to reduce emissions of incomplete combustion
- Watering dirt roads during periods of high use to reduce fugitive dust emissions
- Co-location wells and production facilities to reduce new surface disturbance

- Implementation of directional drilling and horizontal completion technologies whereby one well provides access to petroleum resources that would normally require the drilling of several vertical wellbores

- Requiring that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored

- Performing interim reclamation to reclaim areas of the pad not required for production facilities and to reduce the amount of dust from the pads

Additionally, the BLM encourages oil and natural gas companies to adopt proven, cost-effective technologies and practices that improve operational efficiency and reduce natural gas emissions.

In October 2012, EPA promulgated air quality regulations for completion of hydraulically fractured gas wells. These rules require air pollution mitigation measures that reduce the emissions of VOCs during gas well completions. Mitigation includes a process known as "Green Completion" in which natural gas brought up during flowback must be recaptured and rerouted into the gathering line. In addition, at the APD stage, the BLM would encourage operators to participate in the voluntary STAR program.

4.7.2 Climate and Climate Change

The administrative act of leasing the proposed federal minerals would not result in any direct GHG emissions. However, in regard to future development, the assessment of GHG emissions and climate change is in its formative phase. While it is not possible to accurately quantify potential GHG emissions in the affected area of the proposed leases, some general assumptions can be made: the proposed leases may contribute to the installation and production of new wells, which may consequently lead to an increase in GHG emissions.

Emissions from fossil fuel production grew 101% from 1990 to 2005 and are projected to increase by a further 10% between 2005 and 2020. The natural gas industry is the major contributor to both GHG emissions and emissions growth, with CH_4 emissions from coal mining second. That said, it is worth noting that a significant portion of the emissions attributed to the natural gas industry are due to vented gas from processing plants, many of which are used for injection in enhanced oil recovery operations. Additionally, many technological advances in emission control technology have been implemented by the oil and gas industry to reduce emission levels.

Many aspects of oil and gas production emit GHGs. The primary aspects include the following:

- Fossil fuel combustion for construction and operation of oil and gas facilities which include vehicles driving to and from production sites, engines that drive drill rigs, etc. These produce CO_2 in quantities that vary depending on the age, types, and conditions of the equipment as well as the targeted formation, locations of wells with respect to processing facilities and pipelines, and other site-specific factors.

- Fugitive CH_4 is CH_4 that escapes from wells (both gas and oil), oil storage, and various types of processing equipment. This is a major source of global CH_4 emissions. These emissions have been estimated for various aspects of the energy sector, and starting in 2011, producers are required under 40 CFR 98, to estimate and report their CH_4 emissions to the EPA.

- It is expected that drilling will produce marketable quantities of oil and/or gas. Most of these products will be used for energy, and the combustion of the oil and/or gas would release CO_2 into the atmosphere. Fossil fuel combustion is the largest source of global CO_2.

The assessment of GHG emissions, their relationship to global climatic patterns, and the resulting impacts is an ongoing scientific process. It is currently not feasible to know with certainty the net impacts from the proposed action on climate – that is, while BLM actions may contribute to the climate change phenomenon, the specific effects of those actions on global climate are speculative given the current state of the science. The BLM does not have the ability to associate a BLM action's contribution to climate change with impacts in any particular area. The science to be able to do so is not yet available. The inconsistency in results of scientific models designed to predict climate change on regional or local scales, limits the ability to quantify potential future impacts of decisions made at this level and determining the significance of any discrete amount of GHG emissions is beyond the limits of existing science. When further information on the impact to climate change is known, such information would be incorporated in the BLM's planning and NEPA documents as appropriate.

In recent years, many states and other organizations have initiated GHG inventories, tallying GHG emissions by economic sector. The EPA provides links to statewide GHG emissions inventories (EPA 2014), however this inventory information is not available for Arkansas. Guidelines for estimating project-specific GHG emissions are available (URS Corporation 2010), but some necessary data, including the volume of oil produced and the number of wells, are not available for the proposed action. The uncertainties regarding numbers of wells and other factors make it very impractical to attempt to project amounts of GHG that the proposed action would emit. At the APD stage, more site-specific information on GHG impacts and mitigation measures would be described in detail.

Recent IPCC publications (2013) indicate that due to increasing temperatures, faster evaporation rates, and more sustained droughts brought on by climate change, increasing levels of GHGs contributing to climate change may bring about the following impacts in the southeastern U.S., including LA:

- A shift towards a warmer climate with an increase in extreme high temperatures and a reduction in extreme low temperatures. These changes have been especially apparent in the western half of North America

- Abnormally hot days and nights and heat waves are very likely to become more frequent. Cold days and cold nights are very likely to become much less frequent

- Increasing stress due to heat waves. This may lead to more illness and death, particularly among the young, elderly and frail

- Respiratory disorder may be exacerbated by warming-induced deterioration in air quality

- The growing season length is expected to increase. However, as temperature rises, crops grown in the southwestern U.S. will increasingly experience temperatures above their optimum, and animal production of meat or dairy products will be impacted by temperature extremes

- Weeds and other invasive plants will continue to migrate northward

- Arid areas are very likely to experience increases in erosion and fire risk

- An increase in the length of the forest fire season and the area subject to forest fires

- Additional stress to ground water and surface water sources that are already overtaxed in many areas

- Changes in the abundance and spatial distribution of species and expanded ranges of tree killing insects, vector-borne and tick-borne diseases

- Precipitation is likely to be less frequent but more intense and precipitation extremes are very likely to increase
- Increased weather related losses of property

- Rising sea level in and around the Gulf Coast area

- It is likely that hurricane intensity will increase in response to human-caused warming, but this requires further study

4.7.3 Cumulative Impacts on Air Quality and Climate Change

In February 2014, the BLM completed a documented titled, "The Air Resources Technical Report." The purpose of the document is to summarize the technical information on air quality and climate change relative to all EAs for APDs and lease sales. It includes a description of the varied sources of national and regional emissions that are incorporated here to represent the past, present, and reasonably foreseeable impacts to air resources (USDI 2014). It includes a summary of emissions on the national and regional scale by an industry source. Sources that are considered to have notable contributions to air quality impacts and GHG emissions include electrical generating units, fossil fuel production (nationally and regionally) and transportation.

The very small increase in emissions that could result from approval of the proposed action would not result in the area violating the NAAQS for any criteria pollutant. In October 2012,

EPA regulations that require control of VOC emissions from oil and gas development became effective. These regulations will reduce VOC emissions from oil and gas exploration and production emissions that contribute to the formation of O_3. Emissions from any lease development are not expected to impact the 8-hour average O_3 concentrations, or any other criteria pollutants in the area of the proposed lease.

Visitors to national parks and wilderness areas list the ability to view unobscured scenic vistas as a significant part of a satisfying experience. Unfortunately, visibility impairment has been documented in all Class I areas with visibility monitoring. Most visibility impairment is in the form of regional haze. The greatest visibility impairment due to regional haze occurs in the eastern U.S. and in southern California, while the least impairment occurs in the Colorado Plateau, Nevada Great Basin areas, and in Alaska. Ammonium sulfate contributes at least 50% to visibility impairment at most Class I areas in the eastern U.S. The contribution to visibility impairment from ammonium nitrate is highest in central and southern California and in the Midwest. The largest region of high rural organic carbon visibility impairment is in the southeastern U.S. Impairment in this range is also present in the Sierra Nevada region of California and in the northern Rockies of Montana. The highest contribution to visibility impairment from fine soil is found in the arid Southwest. The highest coarse particle contribution to impairment is also in the arid Southwest and southern California (IPCC 2013). Visibility impairment on federal lands can also result from plume intrusion and has been documented in Mount Zirkel Wilderness, Moosehorn National Wildlife Refuge, and Grand Canyon National Park.

The EPA develops an annual report called the Inventory of U.S. Greenhouse Gas Emissions and Sink (Inventory). According to the Inventory report, in 2012, total GHG emissions in the U.S. were 6,525.6 million metric tons (Tg) CO_{2e}. Total U.S. emissions have increased by 4.7% from 1990 to 2012, and emissions decreased from 2011 to 2012 by 3.4% (227.4 Tg CO_{2e}). The decrease from 2011 to 2012 was due to a decrease in the carbon intensity of fuels consumed by power producers to generate electricity due to a decrease in the price of natural gas, a decrease in transportation sector emissions attributed to a small increase in fuel efficiency across different transportation modes and limited new demand for passenger transportation, and much warmer winter conditions resulting in a decreased demand for heating fuel in the residential and commercial sectors. Since 1990, U.S. emissions have increased at an average annual rate of 0.2%.

The primary GHG emitted by human activities in the U.S. was CO_2 representing approximately 82.5% of total GHG emissions. The largest source of CO_2 and of overall GHG emissions was fossil fuel combustion. CH_4 emissions, which have decreased by 10.8% since 1990, resulted primarily from enteric fermentation associated with domestic livestock, natural gas systems, and decomposition of wastes in landfills. Agricultural soil management, manure management, mobile source fuel combustion and stationary fuel combustion were the major sources of NO_2 emissions.

HFCs and PFCs are families of synthetic chemicals that are used as alternatives to O_3 Depleting Substances (ODS), which are being phased out under the Montreal Protocol and Clean Air Act Amendments of 1990. HFCs and PFCs do not deplete the stratospheric O_3 layer, and are

therefore acceptable alternatives under the Montreal Protocol. These compounds, however, along with SF_6, are potent GHGs. In addition to having high global warming potentials, SF_6 and PFCs have extremely long atmospheric lifetimes, resulting in their essentially irreversible accumulation in the atmosphere once emitted. SF_6 is the most potent GHG the IPCC has evaluated (IPCC 2013). Other emissive sources of these gases include HCFC-22 production, electrical transmission and distribution systems, semiconductor manufacturing, aluminum production, and magnesium production and processing.

ODS substitute emissions and emissions of J-fluorocarbon (JFC)-23 during the production of JCFS-22 were the primary contributors to aggregate HFC emissions. PFC emissions resulted as a by-product of primary aluminum production and from semiconductor manufacturing, while electrical transmission and distribution systems accounted for most SF_5 emissions.

Overall, from 1990 to 2012, total emissions of CO_2 increased by 274.5 Tg CO_{2e} (5.4%), while total emissions of CH_4 decreased by 68.4 Tg CO_{2e} (10.8%), and N_2O increased by 11.5 Tg CO_{2e} (2.9%). During the same period, aggregate weighted emissions of HFCs PFCs, and SF_6 rose by 74.8 Tg CO_{2e} (83%). From 1990 to 2012, HFCs increased by 114.3 Tg CO_{2e} (309.6%), PFCs decreased by 15.2 Tg CO_{2e} (732.8%), and SF_6 decreased by 24.2 Tg CO_{2e} (74.3%). Despite being emitted in smaller quantities relative to the other principal GHGs, emissions of JFCs, PFCs, and SF_6 are significant because many of these gases have extremely high global warming potentials and, in the cases of PFCs and SF_6, long atmospheric lifetimes. Conversely, U.S. GHG emissions were partly offset by carbon sequestration in forests, trees in urban areas, agricultural soils, and landfilled yard trimmings and food scraps, which, in aggregate, offset 15% of total emissions in 2012.

Within the U.S., fossil fuel combustion accounted for 94.2% of CO_2 emissions in 2012. Globally, approximately 32,579 Tg of CO_2 were added to the atmosphere through the combustion of fossil fuels in 2011, of which the U.S. accounted for about 17%. Changes in land use and forestry practices can also emit CO_2 (e.g. through conversion of forest land to agricultural or urban use) or can act as a sink for CO_2 (e.g. through net additions to forest biomass). In addition to fossil fuel combustion, several other sources emit significant quantities of CO_2. These sources include, but are not limited to non-energy use of fuels, iron and steel production and cement production.

The five major fuel consuming sectors contributing to CO_2 emissions from fossil fuel combustion are electricity generation, transportation, industrial, residential, and commercial. CO_2 emissions are produced by the electricity generation sector as they consume fossil fuel to provide electricity to one of the other four sectors, or "end-use" sectors. For the discussion below, electricity generation emissions have been distributed to each end-use sector on the basis of each sector's share of aggregate electricity consumption. This method of distributing emissions assumes that each end-use sector consumes electricity that is generated from the national average mix of fuels according to their carbon intensity.

Transportation End-Use Sector. When electricity-related emissions are distributed to economic end-use sectors, transportation activities accounted for 34.4% of U.S. CO_2 emissions from fossil fuel combustion in 2012. The largest sources of transportation GHGs in 2012 were passenger cars (43.1%), light duty trucks, which include sport utility vehicles, pickup trucks, and minivans

(18.4%), freight trucks (21.9%), commercial aircraft (6.2%), rail (2.5%), and ships and boats (2.2%). These figures include direct emissions from fossil fuel combustion used in transportation and emissions from non-energy use (i.e. lubricants) used in transportation, as well as HFC emissions from mobile air conditioners and refrigerated transport allocated to these vehicle types.

In terms of the overall trend, from 1990 to 2012, total transportation emissions rose by 18% due, in large part, to increased demand for travel with limited gains in fuel efficiency over the same time period. The number of vehicle miles traveled by light-duty motor vehicles (passenger cars and light-duty trucks) increased 35% from 1990 to 2012, as a result of a confluence of factors including population growth, economic growth, urban sprawl, and low fuel prices during the beginning of this period. Almost all of the energy consumed for transportation was supplied by petroleum-based products, with more than half being related to gasoline consumption in automobiles and other highway vehicles. Other fuel uses, especially diesel fuel for freight trucks and jet fuel for aircraft, accounted for the remainder. The primary driver of transportation-related emissions was CO_2 from fossil fuel combustion, which increased by 16% from 1990 to 2012. This rise in CO_2 emissions, combined with an increase in HFCs from close to zero emissions in 1990 to 72.9 Tg CO_{2e} in 2012, led to an increase in overall emissions from transportation activities of 18%.

Industrial End-Use Sector. Industrial CO_2 emissions, resulting both directly from the combustion of fossil fuels and indirectly from the generation of electricity that is consumed by industry, accounted for 27% of CO_2 from fossil fuel combustion in 2012. Approximately 57% of these emissions resulted from direct fossil fuel combustion to produce steam and/or heat for industrial processes. The remaining emissions resulted from consuming electricity for motors, electric furnaces, ovens, lighting, and other applications. In contrast to the other end-use sectors, emissions from industry have steadily declined since 1990. This decline is due to structural changes in the U.S. economy (i.e., shifts from a manufacturing-based to a service-based economy), fuel switching, and efficiency improvements.

In 2012, CH_4 emissions from coal mining were 55.8 Tg CO_{2e}, which is a 4.0 Tg CO_{2e} (6.7%) decrease below 2011 emission levels. The overall decline of 25.2 Tg CO_{2e} (31.1%) from 1990 results from the mining of less gassy coal from underground mines and the increased use of CH_4 collected from degasification systems.

N_2O is produced by biological processes that occur in soil and water and by a variety of anthropogenic activities in the agricultural, energy-related, industrial, and waste management fields. While total N_2O emissions are much lower than CO_2 emissions, N_2O is approximately 300 times more powerful than CO_2 at trapping heat in the atmosphere (IPCC 2013). Since 1750, the global atmospheric concentration of N_2O has risen by approximately 20% (IPCC 2013). The main anthropogenic activities producing N_2O in the U.S. are agricultural soil management, stationary fuel combustion, fuel combustion in motor vehicles, manure management and nitric acid production.

Emissions resulting from the substitution of ODS (e.g., CFCs) have been consistently increasing, from small amounts in 1990 to 146.8 Tg CO_{2e} in 2012. Emissions from ODS substitutes are both

the largest and the fastest growing source of HFC, PFC, and SF_6 emissions. These emissions have been increasing as phase-out of ODS required under the Montreal Protocol came into effect, especially after 1994, when full market penetration was made for the first generation of new technologies featuring ODS substitutes.

GWP-weighted PFC, HFC, and SF_6 emissions from semiconductor manufacture have increased by 28% from 1990 to 2012 due to the rapid growth of this industry and the increasing complexity of semiconductor products (more complex devices have a larger number of layers that require additional F-GHG using process steps). Within that time span, emissions peaked in 1999, the initial year of the EPA's PFC Reduction/Climate Partnership for the Semiconductor Industry, but have since declined to 3.7 Tg CO_{2e} in 2012 (a 48% decrease relative to 1999).

The National Climate Assessment is a document that summarizes the impacts of climate on the U.S. now and in the future. Over 300 experts working with a 60 member Federal Advisory Committee created the report. Major consequences of a warming climate, as discussed in the National Climate Assessment include significant increases in the number of hot days (95°F or above) and decreases in freezing events. Higher temperatures contribute to the formation of harmful air pollutants and allergens. Higher temperatures are also projected to reduce livestock and crop productivity. Climate change is expected to increase harmful blooms of algae and several disease-causing agents in inland and coastal waters. The number of Category 4 and 5 hurricanes in the North Atlantic and the amount of rain falling in very heavy precipitation events have increased over recent decades, and further increases are projected.

Global sea level rose about eight inches in the last century and is projected to rise another 1 to 4 feet in this century. Large numbers of southeastern cities, roads, railways, ports, airports, oil and gas facilities, and water supplies are vulnerable to the impacts of sea level rise. Major cities like New Orleans, with roughly half of its population below sea level, Miami, Tampa, Charleston, and Virginia Beach are among those most at risk. As a result of current sea level rise, the coastline of Puerto Rico around Rincòn is being eroded at a rate of 3.3 feet per year. Puerto Rico has one of the highest population densities in the world, with 56% of the population living in coastal municipalities.

Sea level rise and storm surge can have impacts far beyond the area directly affected. Sea level rise combines with other climate-related impacts and existing pressures such as land subsidence, causing significant economic and ecological implications. According to a recent study co-sponsored by a regional utility, coastal areas in Alabama, Mississippi, Louisiana, and Texas already face losses that annually average $14 billion from hurricane winds, land subsidence, and sea level rise. Losses for the 2030 timeframe could reach $23 billion assuming a nearly 3% increase in hurricane wind speed and just under 6 in of sea level rise. About 50% of the increase in losses is related to climate change. LA State Highway 1, heavily used for delivering critical oil and gas resources from Port Fourchon, is sinking, at the same time sea level is rising, resulting in more frequent and more severe flooding during high tides and storms. A 90-day shutdown of this road would cost the nation an estimated $7.8 billion.

Freshwater supplies from rivers, streams, and groundwater sources near the coast are at risk from accelerated saltwater intrusion due to higher sea levels. Porous aquifers in some areas make them

particularly vulnerable to saltwater intrusion. For example, officials in the city of Hallandale Beach, Florida, have already abandoned six of their eight drinking water wells. Continued urban development and increases in irrigated agriculture will increase water demand while higher temperatures will increase evaporative losses. All of these factors will combine to reduce the availability of water in the Southeast. Severe water stress is projected for many small Caribbean islands.

While recognizing that many factors besides climate change affect energy demand (including population changes, economic conditions, energy prices, consumer behavior, conservation programs, and changes in energy-using equipment), increases in temperature will result in increased energy use for cooling and decreased energy use for heating. These impacts differ among regions of the country and indicate a shift from predominantly heating to predominantly cooling in some regions with moderate climates. For example, in the Northwest, energy demand for cooling is projected to increase over the next century due to population growth, increased cooling degree days, and increased use of air conditioners as people adapt to higher temperatures. Population growth is also expected to increase energy demand for heating. However, the projected increase in energy demand for heating is about half as much when the effects of a warming climate are considered along with population growth.

In sum, the cumulative impacts may result in a very small increase in GHG emissions but are not expected to create climate change impacts that differ from the No Action Alternative because climate change is a global process that is impacted by the sum total of GHGs in the Earth's atmosphere. The incremental contribution to global GHGs from the proposed action cannot be translated into effects on climate change globally or in the area of this site-specific action. It is currently not feasible to predict with certainty the net impacts from particular emissions associated with a federal action; however, EPA's recently finalized oil and gas air quality regulations have a co-benefit of CH_4 reduction that will reduce GHG emissions from any oil and gas development that would occur on this lease.

4.8 Water Quality, Surface/Ground

While the act of leasing federal minerals would produce no impacts to water resources, subsequent exploration and development of the lease parcels may produce impacts. The physical effects of mineral extraction include erosion, compaction, sedimentation, and potential groundwater contamination. Sedimentation and pollution of streams or wetlands can occur down-gradient from such activity sites (USDA 1999). Surface disturbance from the construction of well pads, access roads, pipelines, and utility corridors can result in degradation of surface water and groundwater quality from non-point source pollution, increased soil losses, and increased erosion.

4.8.1 Surface Water Resources

Potential impacts to surface water that may occur due to construction of well pads, access roads, fracturing ponds, pipelines, utility lines and production include:

- Increased surface runoff and off-site sedimentation brought about by soil disturbance

- Increased salt loading and water quality impairment of surface waters

- Channel morphology changes due to road and pipeline crossings and possible contamination of surface waters by spills

The magnitude of these impacts to water resources would depend on the proximity of the disturbance to the drainage channel, slope aspect and gradient, degree and area of soil disturbance, amount of local precipitation, soil character, and duration and time before implementation mitigation or clean up measures can be put into place.

Direct impacts would likely be greatest shortly after the start of construction activities and would decrease in time due to decreased activity during production, natural stabilization and reclamation efforts. Construction activities would occur over a relatively short period, therefore, the majority of the disturbance would be temporary and localized. Flows of perennial, ephemeral, or intermittent rivers and streams could be directly affected in the short term by an increase in impervious surfaces resulting from the construction of the well pad and road. An increase in impervious surfaces provides for reduced infiltration which can then cause overland to move more quickly causing peak flow to potentially occur earlier, have a higher flow velocity and/or a larger volume then the channels are equipped for. Increased velocity and volume of peak flow can cause bank erosion, channel widening, downward incision, and disconnection to the floodplain. The potential hydrologic effect to low flow is reduced surface storage and groundwater recharge, which can then result in reduced base flow to perennial rivers and/or streams and potentially causing intermittent channels to become ephemeral. Hydrologic processes may be altered where the perennial, ephemeral, and intermittent river and stream system responds by changing physical parameters, such as channel configuration. These changes may in turn impact water quality and ultimately the aquatic ecosystem through eutrophication, changes in water temperature, and/ or a change in the food structure.

Minor long-term direct and indirect impacts to the watershed and hydrology could continue for the life of surface disturbance from water discharge from roads, road ditches, and well pads, but would decrease once all well pads and road surfacing material has been removed and reclamation of well pads, access roads, pipelines, and powerlines have taken place. Interim reclamation of the portion of the well pad not needed for production operation, re-vegetating the portion of the pad that is needed for production operations, and re-vegetating road ditches would reduce this long-term impact. Short-term direct and indirect impacts to the watershed and hydrology from access roads that are not surfaced with impervious materials would occur and would likely decrease in time due to reclamation efforts. Cumulative effects to surface water are not anticipated. If the BLM COAs as outlined below are followed during the APD process, cumulative impacts to surface water should not occur.

4.8.2 Ground Water Resources

Groundwater could be affected by multiple factors, including industrial, domestic, or agricultural activities through withdrawal, injection (including chemical injection), or mixing of materials from different geologic layers or the surface. Withdrawal of groundwater could affect local

groundwater flow patterns and create changes in the quality or quantity of the remaining groundwater. Loss of a permitted source of groundwater supply due to drawdown would be considered a significant impact if it were to occur. This potential would be assessed at the development stage should development be proposed. The drilling of horizontal wells, versus directional and vertical wells may initially appear to require a greater volume of water for drilling/completion purposes. However, a horizontal well develops a much larger area of the reservoir than a directional and/or vertical well and actually results in a lesser volume of fluids being required. Vertical and directional wells can easily require one well per 10 acres resulting in 64 wells per section. This is in contrast to one horizontal well per 640 acres or one per 320 acres which results in a net decrease in total fluid volumes needed and in surface disturbance acreages. Impacts to the quality of groundwater, should they occur, would likely be limited to near a well bore location due to inferred groundwater flow conditions in the area of the parcels.

Oil and gas contained in geologic formations is often not under sufficient hydraulic pressure to flow freely to a production well. The formation may have low permeability or the area immediately surrounding the well may become packed with cuttings. A number of techniques are used to increase or enhance the flow. They include hydraulic fracturing and acid introduction to dissolve the formation matrix and create larger void space(s). The use of these flow enhancement techniques and secondary recovery methods result in physical changes to the geologic formation that will affect the hydraulic properties of the formation. Typically, the effects of these techniques and methods are localized to the area immediately surrounding the individual well, are limited to the specific oil and gas reservoir, and do not impact adjacent aquifers.

In recent years there has been an elevated public concern about the possibility of subsurface hydraulic fracturing operations creating fractures that extend well beyond the target formation to water aquifers, allowing CH_4, contaminants naturally occurring in formation water, and fracturing fluids to migrate from the target formation into drinking water supplies (Zoback et al 2010). Typically, thousands of feet of rock, including some impermeable, separate most major formations in the U.S. from the base of aquifers that contain drinkable water (U.S. Department of Energy, 2009). The direct contamination of underground sources of drinking water from fractures created by hydraulic fracturing would require hydrofractures to propagate several thousand feet beyond the upward boundary of the target formations through many layers of rock. It is extremely unlikely that the fractures would ever reach fresh water zones and contaminate freshwater aquifers (Zoback et al 2010). During the APD review, the exact difference between the base of treatable water and the top of the target formation for the specific site would be reviewed to determine the potential for direct contamination of underground sources.

Contamination of groundwater could occur without adequate cementing and casing of the proposed well bore. For fracturing fluid to escape the wellbore and affect the usable quality water or contaminate or cross contaminate aquifers, the fluid would have to breech several layers of steel casing and cement. Failure of the cement or casing surrounding the wellbore is a possible risk to water supplies. If the annulus is improperly sealed, natural gas, fracturing fluids, and formation water containing high concentrations of dissolved solids may be transferred directly along the outside of the wellbore among the target formation, drinking water aquifers, and layers of rock in between. Complying with BLM and state regulations regarding casing and cementing, implementing BMPs, testing casings and cement prior to continuing to drill or introducing

additional fluids and continual monitoring during drilling and hydraulic fracturing, allow producers and regulators to check the integrity of casing and cement jobs and greatly reduce the chance of aquifer contamination.

Casing specifications are designed and submitted to the BLM. The BLM independently verifies the casing program, and the installation of the casing and cementing operations are witnessed by a Petroleum Engineer. Petroleum products and other chemicals used in the drilling and/or completion process could result in groundwater contamination through a variety of operational sources including but not limited to pipeline and well casing failure, well (gas and water) construction, and spills. Similarly, improper construction and management of reserve and evaporation pits could degrade ground water quality through leakage and leaching.

The potential for negative impacts to groundwater caused from completion activities such as hydraulic fracturing have not been confirmed but based on its history of use are not likely. A recent study completed on the Pinedale Anticline did not find a direct link to known detections of petroleum hydrocarbons to the hydraulic fracturing process. Authorization of the proposed project would require full compliance with local, state, and federal directives and stipulations that relate to surface and groundwater protection and the BLM would deny any APD who proposed drilling and/or completion process was deemed to not be protective of usable water zones as required by 43 CFR 3162.5-2(d).

A high risk of fluid migration exists along the vertical pathways created by inadequately constructed wells and unplugged inactive wells. Brine or hydrocarbons can migrate to overlying or underlying aquifers in such wells. This problem is well known in the oil fields around Midland, TX. Since the 1930s, most States have required that multiple barriers be included in well construction and abandonment to prevent migration of injected water, formation fluids, and produced fluids. These barriers include (1) setting surface casing below all known aquifers and cementing the casing to the surface, and (2) extending the casing from the surface to the production or injection interval and cementing the interval. Barriers that can be used to prevent fluid migration in abandoned wells include cement or mechanical plugs. They should be installed (1) at points where the casing has been cut, (2) at the base of the lowermost aquifer, (3) across the surface casing shoe, and (4) at the surface. Individual states, and the BLM have casing programs for oil and gas wells to limit cross contamination of aquifers.

Impacts of water use for oil and gas development and production depend on local water availability and competition for water from other users. Overall, impacts range from declining water levels at the regional or local scales and related decreases in base flow to streams (Nicot & Scanlon, 2012). Water supplied for hydraulic fracturing could come from surface or groundwater sources. If surface water is used, there could be a temporary decrease in the source's water levels depending upon the conditions at the time of withdrawl. The time it takes to return to baseline conditions is dependent on the amount of rainfall received and other competing uses of the resource.

Typically when groundwater is used as a source of drilling/completion water, impacts to the aquifer would be minimal due to the size of the aquifers impacted and recharge potential across the entire aquifer. However, localized aquifer effects could be expected depending upon the rate

of drawdrown and the density and/or intensity of the drilling activity. A cone of depression may occur in the immediate vicinity of the existing water well used to supply the drilling/completion water. With each rain event, the aquifer is expected to recharge to some degree, but it is unknown if or when it would recharge to baseline conditions after pumping ceases which is dependent upon surface conditions (whether impervious surface or not). The time it takes depends greatly on rainfall events, surface soil materials, drought conditions, and frequency of pumping that has already occurred and will continue to occur into the future. The amount of water actually used for drilling/completion activities is highly dependent on a number of factors including: length of well bore, closed-loop or reserve pit drilling system, type of mud, whether hydraulic fracturing would be used during stimulation, whether recycled water would be used, dust abatement needs, and type and extent of construction, to name a few. The impacts of water use on water quality and quantity would be analyzed in more detail during the APD review.

Any proposed drilling/completion activities would have to be in compliance with Onshore Order #2, 43 CFR 3160 regulations, and not result in a violation of a federal and/or state law. If these conditions were not met, the proposal would be denied. As such, no significant impacts to groundwater from the proposed action are expected. Cumulative effects to ground water are not anticipated. If the BLM COAs as outlined below are followed during the APD process, cumulative impacts to ground water should not occur.

4.8.3 Mitigation

The BLM recommends BMPs requiring fluid impermeable containment systems (i.e. liners, dikes, berms) be placed in, under and/or around any tank, pit, drilling cellar, ditches associated with the drilling process, or other equipment that use or has the potential to leak/spill hazardous and non-hazardous fluids, to prevent chemicals from penetrating the soil and impacting the aquifer or from moving off-site to a surface water source.

The BLM will closely analyze areas proposed for drilling in APDs during the onsite inspection, since regional wetland inventories often do not capture small wetlands. EPA requires that Storm Water Pollution Prevention Plans and SPCCP be in place to prevent any spill from reaching surface water due to rain events or accidental release of fluids related to production operations.

4.9 Wetlands/Riparian Areas/Floodplains

While the act of leasing federal minerals would produce no direct impacts to wetland/riparian areas, these areas could be adversely impacted by subsequent mineral development (drilling, hydraulic fracturing, production, et.) by changing the water quality or quantity (chemical spills, storm water runoff, etc.). Cumulative effects to wetlands are not anticipated. If the BLM COA as outlined below is followed during the APD process, cumulative impacts to wetlands should not occur.

4.9.1 Mitigation

To protect the water quality of watersheds and natural stream substrate and morphology and to avoid potential impacts to aquatic species and their habitat, a BLM stipulation regarding

freshwater aquatic habitat applies to this lease. The stipulation states that no surface occupancy or disturbance, including discharges, are permitted within 250 feet of a river, stream, wetland spring, headwater, wet meadow, wet pine savanna, pond, tributary, lake, coastal slough, sand bar, vernal pools, calcareous seepage marsh, or small, marshy calcareous stream.

4.10 Invasive/Exotic Species

While the act of leasing federal minerals would not contribute to the spread or control of invasive or non-native species, subsequent exploration/development of the proposed lease may. Any surface disturbance could establish new populations of invasive non-native species, although the probability of this happening cannot be predicted using existing information. Noxious weed seeds can be carried to and from the project areas by construction equipment, the drilling rig and transport vehicles. At the APD stage, BLM requirements for use of weed control strategies would minimize the potential for the spread of these species.

4.10.1 Mitigation

Mitigation is deferred to site-specific development at the APD stage. BMPs require that all federal actions involving surface disturbance or reclamation take reasonable steps to prevent the introduction or spread of noxious weeds, including requirements to use weed-free hay, mulch and straw. A BLM COA applies to all APDs which recommends that native cover plants in seeding mixtures be used during reclamation activities. Post-construction monitoring for cogon grass and other invasive plant species should be conducted to ensure early detection and control. If invasive species are found, the proper control techniques should be used to either eradicate the species from the area or minimize its spread to other areas. If cogon grass is found on site, equipment should be washed before exiting the site to prevent the spread of this highly invasive species to other locations.

4.11 Special Status Species

There is no suitable habitat on EOI #1552 for the bald eagle, piping plover, interior least tern, and Arkansas River shiner. Therefore, BLM has determined that there will be no effect on these species from the proposed project. There is potential suitable habitat present for the northern long-eared bat (foraging habitat), Ozark big-eared bat (foraging habitat), and American burying beetle. As a result, BLM has determined that the proposed project may affect, but is not likely to adversely affect these species. There is no suitable habitat on EOI #1561 for the piping plover, rabbitsfoot, speckled pocketbook, interior least tern, snuffbox, and yellowcheek darter. As a result, BLM has determined that the proposed lease will have no effect on any of these species. There is potential suitable habitat for the bald eagle, northern long-eared bat, gray bat (foraging habitat), Ozark big-eared bat (foraging habitat), and Indiana bat. Informal consultation with FWS, Arkansas Ecological Services was initiated on January 16, 2015. FWS responded on February 25, 2015 stating that they concur with BLM's determinations (Appendix C).

A request was submitted to the ANHC on January 16, 2015 to review their files for records indicating the occurrence of rare plants and animals, outstanding natural communities, natural or scenic rivers, or other elements of special concern within or near the project site. A response was

received on January 30, 2015. ANHC comments have been incorporated into the following sections of this EA: Northern Long-eared Bat (Section 3.11.1.1.3) and American Burying Beetle (3.11.1.1.5). In addition, ANHC provided a list of species of special concern occurrence records located within five miles of each of the lease parcels and can be found in Appendix F.

4.11.1 Mitigation Relevant to All Special Status Species

Due to potential future changes in species habits, habitat needs, and our knowledge thereof, a BLM stipulation regarding rare species applies to this proposal. The BLM stipulation states that the BLM may recommend modifications to exploration and development proposals to further the conservation and management objectives for threatened, endangered, or other special status plant or animal species or their habitat to avoid BLM-approved activity that would contribute to a need to list such a species or their habitat. To protect threatened, endangered, candidate, proposed, and BLM sensitive plant species, a second stipulation applies to these leases. The stipulation states that all suitable special status plant species habitat will be identified during environmental review of any proposed surface use or activity. If field examination indicates that habitat of one or more of these species is present, the BLM will require a survey by a qualified botanist for special status plants during periods appropriate to each species. Operations will not be allowed in areas where sensitive plants would be affected.

4.12 Vegetation and Wildlife

While the act of leasing federal minerals would produce no direct impacts to wildlife, subsequent development of a lease may produce impacts. Impacts could result from increased habitat fragmentation, noise, or other disturbance during development. Although reclamation and restoration efforts for surface disturbance could provide for the integrity of other resources, these efforts may not always provide the same habitat values (e.g. structure, composition, cover, etc.) in the short or in some instance, the long-term, in complex vegetative community types (e.g., shrub oak communities). Short-term negative impacts to wildlife would occur during the construction and production phase of the operation (drilling, fracturing, production, etc.) due to noise and habitat destruction. In general, most wildlife species would become habituated to the new facilities. For other wildlife species with a low tolerance to activities, the operations on the well pad would continue to displace wildlife from the area due to ongoing disturbances such as vehicle traffic, noise and equipment maintenance. The magnitiude of above effects would be dependent on the rate and location of the oil and gas development, but populations could likely not recover to pre-disturbance levels until the activity was completed and vegetative community restored. Cumulative effects on wildlife and vegetation from potential development on the proposed leases could include an overall loss of suitable habitat.

The RFD for EOI # 1552 predicts that 2 federal horizontal wells will be drilled from 2 pads. The total disturbance predicted would be 2.87 acres, with 2.87 acres disturbed for the well pad and pit, 0.68 acres for the access road, and 0.68 acres reclaimed (Appendix D). The RFD for EOI #1561 predicts that 1 federal horizontal wells will be drilled from 1 pad. The total disturbance predicted would be 2.00 acres, with 1.43 acres disturbed for the well pad and pit, 0.91 acres for the access road, and 0.34 acres reclaimed (Appendix D).

Many of the common species expected to occur on the lease parcels have broad habitat requirements and would continue to be found in a variety of habitats in the surrounding areas. Wildlife use of the site after the well is put into production would vary depending on vegetation and succession stage. Once put into production, the well pad would be reduced in size and the reserve pit would be graded and seeded. The producing well site would be subject to regular maintenance and inspection. Wildlife use of the site is dependent on the adequacy of restoration. However, over the life of the well, some of the acreage would be excluded from utilization by most wildlife species.

4.12.1 Mitigation Common to All Species

Measures would be taken to prevent, minimize, or mitigate impacts to fish and wildlife animal species from exploration and development activities. Prior to authorization, activities would be evaluated on a case-by-case basis, and the project would be subject to mitigation measures. Mitigation could potentially include rapid re-vegetation, noise restrictions, project relocation, or pre-disturbance wildlife species surveying.

A standard BLM COA would apply at the APD stage that is designed to prevent bat and bird mortality. The COA states that all open vent stack equipment, such as heater-treaters, separators, and dehydrator units, will be designed and constructed to prevent birds and bats from entering or nesting in or on such units, and to the extent practical, to discourage birds from perching on the stacks. Installing cone-shaped mesh covers on all open vents is one suggested method. Flat mesh covers are not expected to discourage perching and will not be acceptable.

4.13 Migratory Bird Species of Concern

While the act of issuing the proposed leases produces no impacts to migratory birds, subsequent exploration/development of the subject parcels may produce impacts. Surface disturbance from the development of well pads, access roads, pipelines, and utility lines can result in an impact to migratory birds and their habitat. Cumulative effects on migratory birds could increase as oil and gas development increases in the area. The extent of the effect will be dependent on the amount of increase in development.

FWS estimates that many migratory birds are killed annually throughout the U.S. in oil field production skim pits, reserve pits, and centralized oilfield wastewater disposal facilities. Numerous grasshoppers, moths, June bugs, and the like become trapped on the surface in tanks and on pits, and become bait for many species of migratory birds. Open tanks and pits then become traps to many species of birds protected under the MBTA. Properly covered tanks and pits (and regularly inspected covered tanks and pits) is imperative to the continued protection of migratory birds in the well pad area.

4.13.1 Mitigation

Per the MOU between BLM and FWS, entitled, "To Promote the Conservation of Migratory Birds," the following temporal and spatial conservation measures must be implemented as part of the COAs with an APD:

1. Avoid any take of migratory birds and/or minimize the loss, destruction, or degradation of migratory bird habitat while completing the proposed project or action.

2. If the proposed project or action includes a reasonable likelihood that take of migratory birds will occur, then complete actions that could take migratory birds outside of their nesting season. This includes clearing or cutting of vegetation, grubbing, etc. The primary nesting season for migratory birds varies greatly between species and geographic location, but generally extends from early April to mid-July. However, the maximum time period for the migratory bird nesting season can extend from early February through late August. Strive to complete all disruptive activities outside the peak of migratory bird nesting season to the greatest extent possible.

3. If no migratory birds are found nesting in the proposed project or action areas immediately prior to the time when construction and associated activities are to occur, then the project activity may proceed as planned.

To protect perch and roosting sites and terrestrial habitats for and to avoid potential impacts to migratory birds, the following standard BLM COAs would apply at the APD stage:

- Any reserve pit that is not closed within 10 days after a well is completed and that contains water must be netted or covered with floating balls, or another method must be used to exclude migratory birds

- All powerlines must be built to protect raptors and other migratory birds, including bald eagles, from accidental electrocution, using methods detailed by the Avian Power Line Interaction Committee

4.14 No Action Alternative

Under the No Action Alternative, the proposed lease parcels would not be made available for lease. There would be no subsequent impacts from oil and/or gas construction, drilling, and production activities. The No Action Alternative would result in the continuation of the current land and resource uses in the proposed lease areas.

4.14.1 Environmental Justice

By not offering the proposed federal minerals for lease under the No Action Alternative, there may be negative effects on the overall employment opportunities related to the oil and gas and service support industry, as well as a loss of the economic benefits to state and parish governments related to royalty payments and severance taxes. However, there would be no increase in activity and noise associated with these leases unless the land is used for other purposes.

4.14.2 Cultural Resources and Native American Concerns

If the proposed leases are not made available and cultural resource surveys are not conducted, direct and indirect impacts may occur. Direct impacts are those such as completely destroying a site by "relic hunters" or by people picking up artifacts. Other direct impacts may be the mixing of layers in a site by plowing or the destruction of a site by land leveling. Indirect impacts are those such as after timber thinning or clear-cutting resulting in erosion of a site.

4.14.3 Mineral Resources

Under the No Action Alternative there would be no new impacts from oil and gas production on the lease parcels. Oil and gas development of federal, state, and private minerals would continue on the land surrounding the lease parcels. No additional natural gas or crude oil from the parcels would enter the public markets and no royalties would accrue to the federal or state treasuries. An assumption is that the No Action Alternative would not affect current domestic production of oil and gas. However, this may result in reduced federal and state royalty income, and the potential for federal land to be drained by wells on adjacent private or state land. Oil and gas consumption is driven by a variety of complex interacting factors including energy costs, energy efficiency, availability of other energy sources, economics, demography, and weather or climate. If the BLM were to forego issuing the leases and potential development of the subject parcels, the assumption is that the public's demand for the resource would not be expected to change. Instead, the mineral resource foregone would be replaced in the short- and long-term by other sources that may include a combination of imports, using alternative energy sources (e.g. wind, solar), and other domestic production. This offset in supply would result in a no net gain for oil and gas domestic production.

4.14.4 All Other Resources

No other resources would be affected under the No Action Alternative, as there would be no surface disturbance that could detrimentally affect these resources. The No Action Alternative would result in the continuation of the current land and resource uses on the parcels.

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FINDING OF NO SIGNIFICANT IMPACT/DECISION RECORD

FINDING OF NO SIGNIFICANT IMPACT

Based on the analysis of potential environmental impacts contained in the attached environmental assessment (EA), I have determined that the proposed action will not have any significant impacts on the human environment and an environmental impact statement (EIS) is not required.

_____ _____

Elena Fink, DSD, Natural Resources Date

DECISION RECORD

It is my decision to authorize the offer to lease for Oil and Gas the proposed tracts located in Logan and Pope Counties, Fifth Principal Meridian, Arkansas with legal descriptions: T7N, R26W, Sec. 22, SWNW, NWSW, Sec. 23, N2SESE, Logan County, Arkansas (EOI #1552) and T9N, R21W, Sec. 5, SWSE, Pope County, Arkansas (EOI #1561).

Rationale for Decision

The decision to allow the proposed action does not result in any undue or unnecessary environmental degradation and is consistent with the laws and regulations of the federal, state, or local government. The proposed action was subject to a 30-day public review.

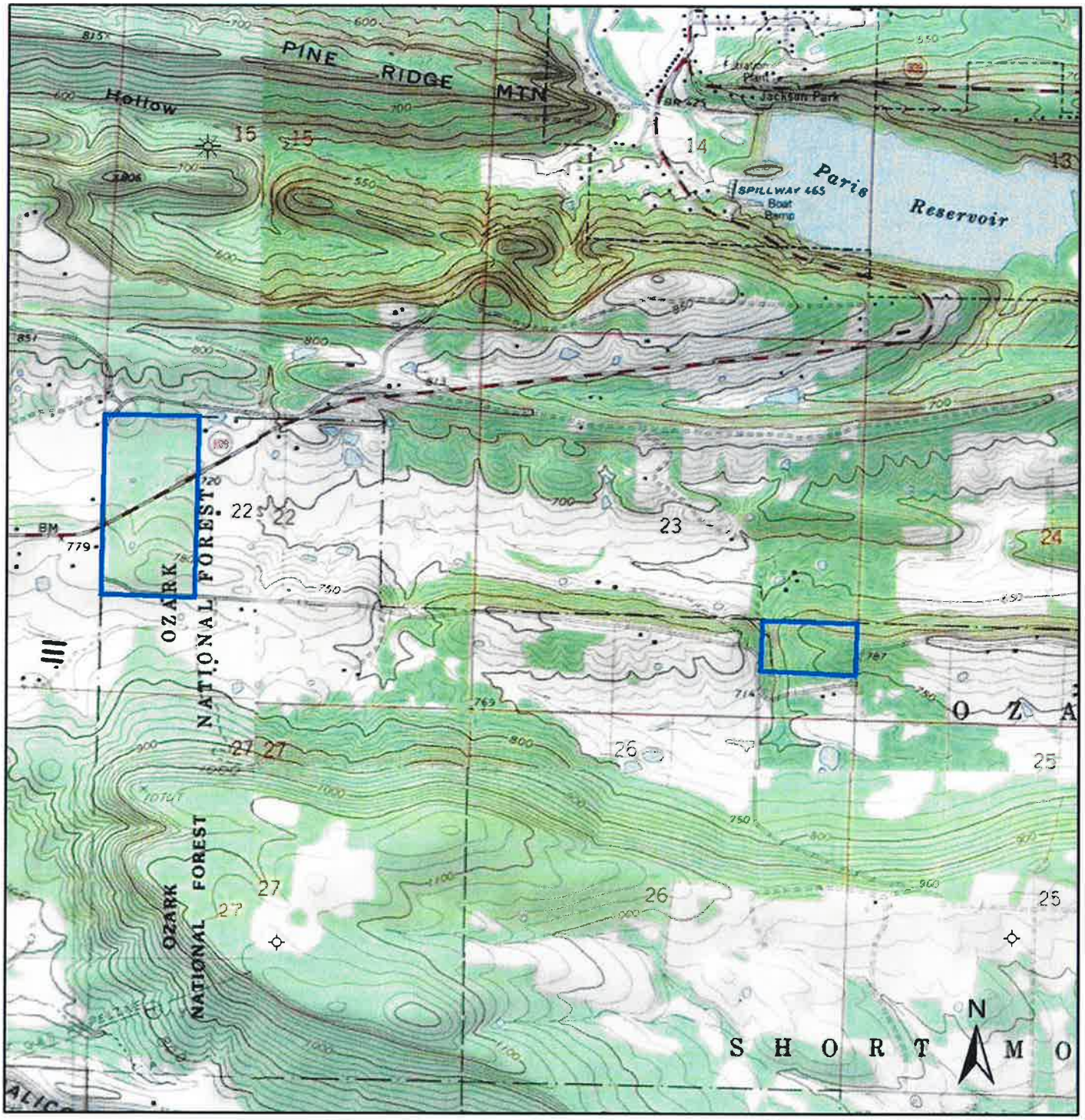
_____ _____

Elena Fink, DSD, Natural Resources Date

APPENDIX A

Parcel Topographic Maps

Proposed Federal Oil and Gas Lease
EOI 1552



Proposed Lease Area

Oil and Gas Wells

Dry Hole, Temporarily Abandoned

Gas Well

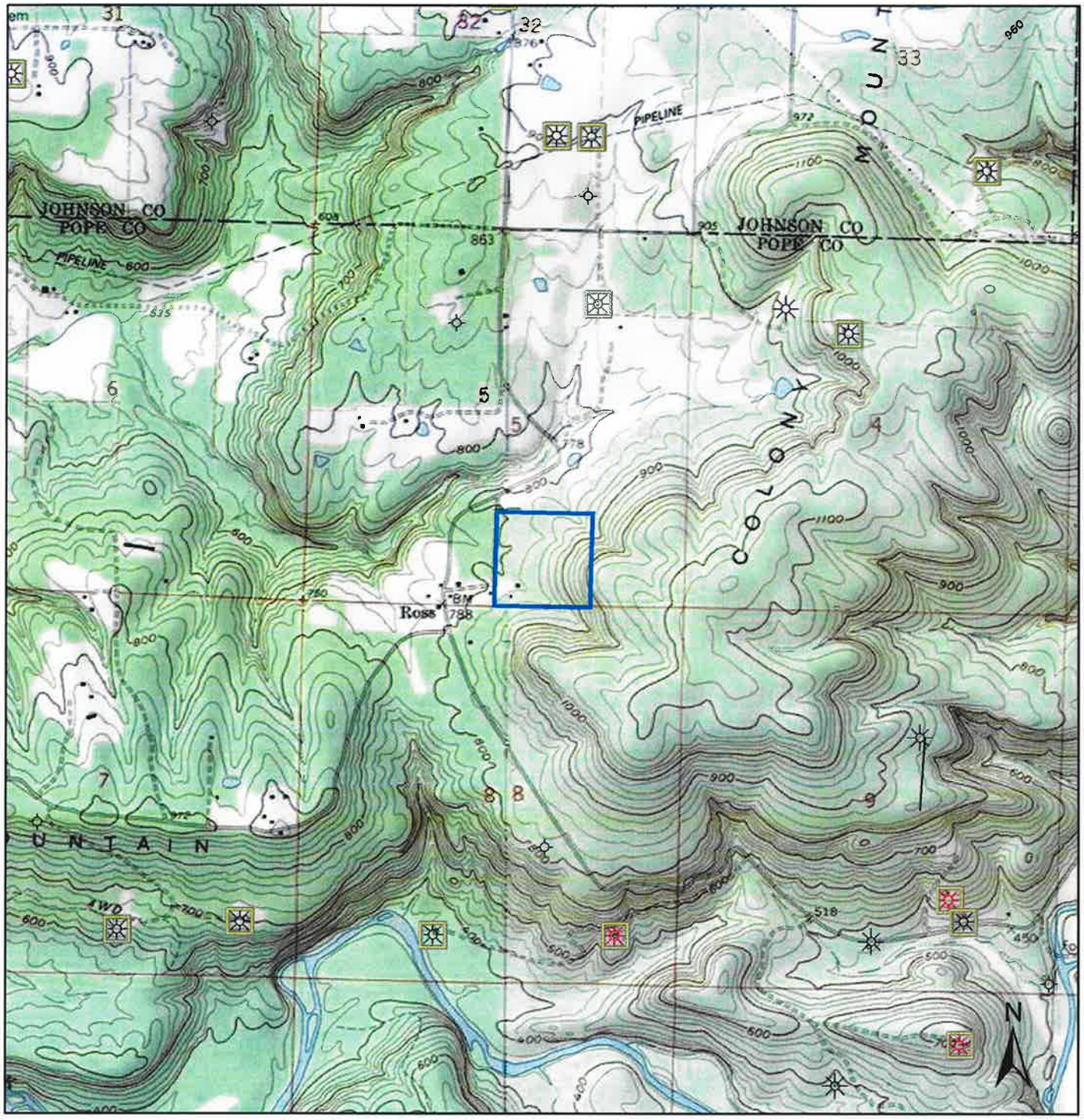
Proposed Lease Area:
Logan County, Arkansas, 5th Principal Meridian
T. 7N., R. 26W., Sec.22, SWNW, NWSW
Sec.23, N1/2SESE
Approximately 100 acres.

U.S. Department of the Interior
Bureau of Land Management
Eastern States
Southeastern States Field Office
Jackson, Mississippi

This map contains portions of the following USGS 1:24,000 Topographic Ouadrangles: Paris, Blue Mountain, Caulksville, Magazine

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of this data for individual use or aggregate use with other data.

Proposed Federal Oil and Gas Lease
EOI 1561



Proposed Lease Area

Oil and Gas Wells

- Dry Hole, Temporarily Abandoned
- Gas Well
- Multiple Completion, Gas
- Inactive Wells
- Well Bore Path

Proposed Lease Area:
Pope County, Arkansas, 5th Principal Meridian
T. 9N., R. 21W., Sec.5, SWSE
Approximately 39.86 acres.

U.S. Department of the Interior
Bureau of Land Management
Eastern States
Southeastern States Field Office
Jackson, Mississippi

This map contains portions of the following USGS 1:24,000 Topographic Quadrangles: Lee Mountain, Knoxville

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of this data for individual use or aggregate use with other data.

APPENDIX B

Proposed Lease Stipulations and Lease Notices

Stipulations

Cultural Resources and Tribal Consultation

Stipulation: This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, or other statutes and executive orders. The BLM will not approve any ground disturbing activities that may affect any such properties or resources until it completes its obligations under applicable requirements of the NHPA and other authorities. These obligations may include a requirement that you provide a cultural resources survey conducted by a professional archaeologist approved by the State Historic Preservation Office (SHPO). If currently unknown burial sites are discovered during development activities associated with this lease, these activities must cease immediately, applicable law on unknown burials will be followed and, if necessary, consultation with the appropriate tribe/group of federally recognized Native Americans will take place. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized or mitigated.

Endangered Species

Stipulation: The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 U.S.C. ' 1531 et seq., including completion of any required procedure for conference or consultation.

Exception: None

Modification: None

Waiver: None

Sensitive Plant Species

Stipulation (CSU): All suitable special status plant species habitat will be identified during environmental review of any proposed surface use activity. If field examination indicates that habitat of one or more of these species is present, the BLM will require a survey by a qualified botanist for special status plants during periods appropriate to each species. Operations will not be allowed in areas where sensitive plants would be affected.

Objective: To protect threatened, endangered, candidate, proposed, and BLM sensitive plant species.

Exception: An exception may be granted if the operator agrees to implement measures developed in consultation with USFWS and in coordination with State agencies.
Modification: The stipulation may be modified if it is determined that a portion of the lease area does not contain sensitive plant species habitat.

Waiver: The stipulation may be waived if, based on field surveys, it is determined that the lease area does not contain sensitive plant species habitat.

Freshwater Aquatic Habitat

Stipulation (NSO): No surface occupancy or disturbance, including discharges, are permitted within 250 feet of a river, stream, wetland spring, headwater, wet meadow, wet pine savanna, pond, tributary, lake, coastal slough, sand bar, vernal pools, calcareous seepage marsh, or small, marshy calcareous stream. If the slope exceeds 10 percent, the buffer may be extended to 600 feet to provide adequate protection for aquatic habitats and associated species.

Objective: To protect the water quality of watersheds and natural stream substrate and morphology and to avoid potential impacts to aquatic species and their habitat.

Exception: An exception may be granted if the operator agrees to 1) span creeks, rivers, wetlands, and floodplains by attaching pipelines to bridges; 2) directionally drill wells and pipelines from upland sites under creeks, rivers, other waters, and wetlands or3) implement other measures developed in consultation with USFWS and in coordination with State agencies.

Modification: The buffer may be reduced if the adjacent waterway has been surveyed for 100 yards upstream and 300 yards downstream of the site, and the results document the lack of suitable/occupied/critical habitat for listed species which may be affected by the project, as determined by the BLM and USFWS.

Waiver: None

Lease Notices/Best Management Practices

Migratory Birds and Federally Listed Wildlife

Objective: To protect perch and roosting sites and terrestrial habitats for and to avoid potential impacts to migratory birds and federally listed wildlife.

Any reserve pit that is not closed within 10 days after a well is completed and that contains water must be netted or covered with floating balls, or another method must be used to exclude migratory birds.

All powerlines must be built to protect raptors and other migratory birds, including bald eagles, from accidental electrocution, using methods detailed by the Avian Power Line Interaction Committee (APLIC 2006)

Perching and Nesting Birds and Bats

Objective: To prevent birds and bats from entering or nesting in or on open vent stack equipment.

Open vent stack equipment, such as heater-treaters, separators, and dehydrator units, will be designed and constructed to prevent birds and bats from entering or nesting in or on such units and, to the extent practical, to discourage birds from perching on the stacks. Installing cone-shaped mesh covers on all open vents is one suggested method. Flat mesh covers are not expected to discourage perching and will not be acceptable.

Invasive and Non-Native Species

Objective: To discourage the spread of invasive, non-native plants.

Use of native or non-invasive plants in seeding mixtures will be encouraged to stabilize disturbed areas and during restoration activities. Construction sites will be surveyed for invasive species prior to ground disturbance. If invasive species are found, the proper control measures will be used to either eradicate the species from the area or minimize its spread to other areas. If cogongrass is found on site, equipment will be washed before exiting the site to prevent the spread of this highly invasive species to other locations. Post-construction monitoring for cogongrass and other invasive plant species should be conducted to ensure early detection control. In the case of split-estate lands, final seed mixtures will be formulated in consultation with the private landowner.

Pesticide Application

Objective: To protect the water quality of watersheds and natural stream substrate and morphology supporting special status species and their host species.

Any ground application of herbicides or other pesticides, sterilants, or adjuvants within 150 feet of listed species or habitat will require site-specific control measures developed in coordination or formal consultation with USFWS. No aerial application of herbicides or pesticides will be permitted.

Produced Water Disposal

Objective: To protect water quality, aquatic habitats, and special status species.

The preferred method for disposal of produced water will be through reinjection to a permeable formation with total dissolved solids (TDS) content higher than 10,000 milligrams per liter (mg/L), and that is not hydrologically connected to caves, wetlands, or surface water. Injection of produced water is regulated by the Underground Injection Control (UIC) program administered by state agencies.

APPENDIX C

Correspondence

United States Department of the Interior

Bureau of Land Management
Southeastern States Field Office
411 Briarwood Drive, Suite 404
Jackson, Mississippi 39206
http://www.es.blm.gov

IN REPLY REFER TO: 8100 (020) JMS Pope Co. EOI 1561

Jan. 13, 2014

Tarpie Yargee, Chief
Alabama-Quassarte Tribal Town
P.O. Box 187
Wetumka, OK 74883

Dear Chief Yargee:

The Bureau of Land Management (BLM) has received an Expression of Interest (EOI 1561) to lease federal minerals under privately owned surface, i.e. split-estate minerals. The Bureau's Reasonably Foreseeable Development scenario (RFD) for this proposed lease is one well to be drilled from one pad, to be constructed on private surface with no more than 2.34 acres total, access road and pad, to be disturbed accessing federal minerals. However, proposed development locations have not been determined on a site-specific basis. Specific locations proposed for development are determined by the developer and surface owners.

The legal locations of the approximately 39.86 acres of federal mineral tracts are as follows (map enclosed):

5th Principal Meridian
Pope County (Lee Mountain and Knoxville Quadrangles)
T. 9 N., R. 21 W., Sec. 5, SWSE (Total 39.86 ac.)

A section of the lease document will state that before the BLM approves any development proposal, a survey that meets current professional standards and a report that meets Arkansas Historic Preservation Program requirements may be required on a site-specific basis. A report of survey results must be approved by both the Arkansas Historic Preservation Program and the BLM before any ground disturbing activities take place. Any needed consultation will be concluded before ground-disturbing activities begin.

In addition, a stipulation will be included in the lease document which covers accidental discovery and requires additional consultation with you and the Arkansas Historic Preservation Program. This stipulation will also be included in the permitting documents when, or if, a development proposal is submitted.

If you are aware of any sites within the proposed lease area which are currently being used for religious purposes or are recognized as sacred sites on these privately owned lands, please let us know so that additional consultation can be conducted and so that impacts will not occur. As provided by and to the extent of the law, any specific location information will be held in confidence. Your information is requested within 30 days.

If you have any questions or comments, please contact John M. Sullivan, Archeologist, at (601) 977-5439 or John_M_Sullivan@BLM.Gov.

Sincerely,

Original Signed
Bruce Dawson

Bruce Dawson
Field Manager

Enclosures
1 - Map

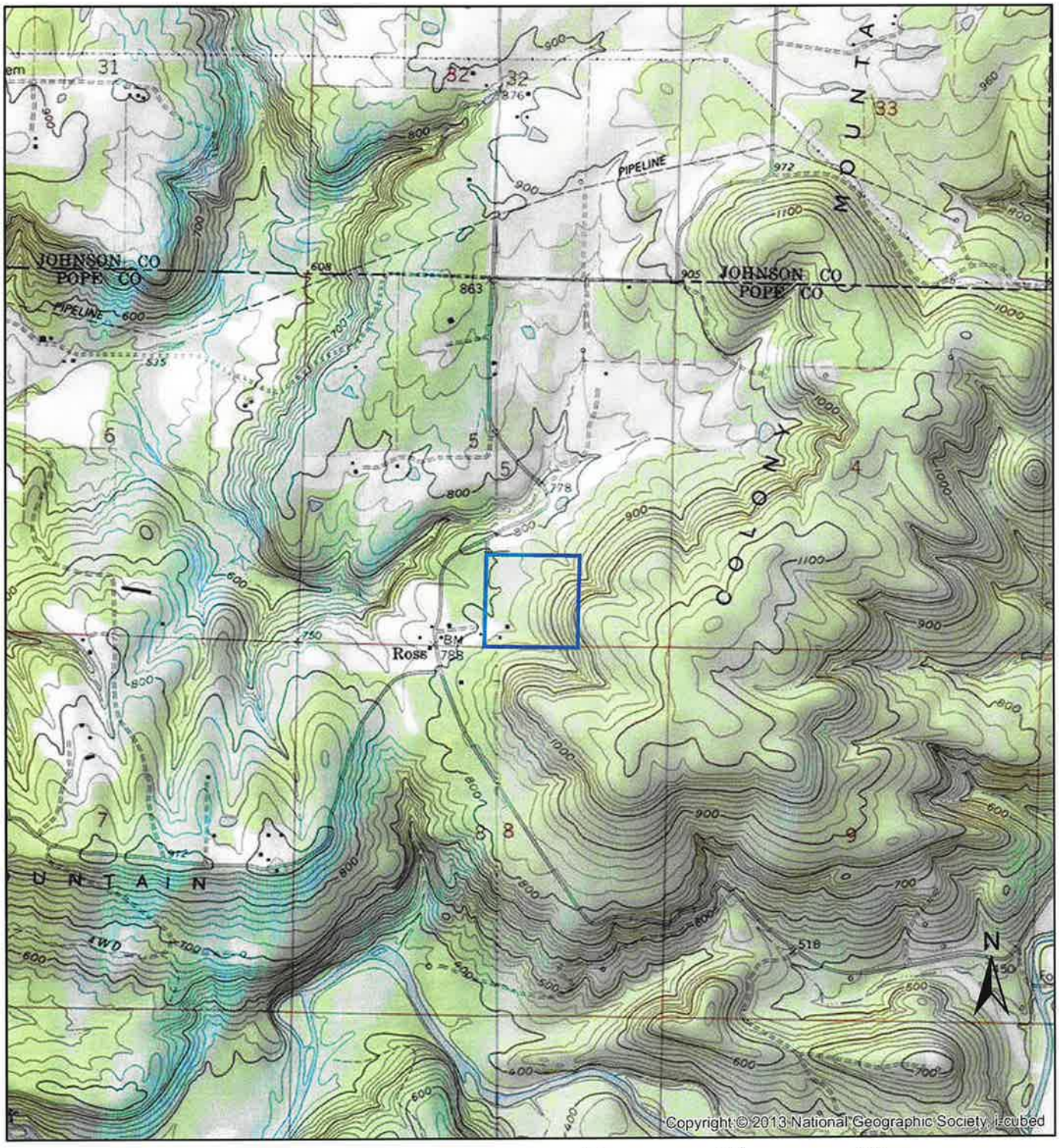
cc via email: Augustine Asbury, 2nd Chief/ Cultural Preservation Officer

bc:
JFO CF & RF
ES RF
DWinters
AMcMartney
ES020:JMSullivan: 01/05/2012:601-977-5400:Pope Co.T.9N.R.21W.Sec.5.EOI 1561.NA Ltr

Original letters to these	CC letters to these
John Berrey, Chairman Quapaw Tribe of Oklahoma P.O. Box 765 Quapaw, Oklahoma 74345	Everett Bandy, THPO P.O. Box 1556 Miami, OK 74355 918-542-1853 ebandy@quapawtribe.com everett.bandy@gmail.com
Earl Barbry, Sr., Chairman Tunica - Biloxi Tribe 151 Melacon Dr. Marksville, Louisiana 71351	Mr. Earl Barbry, Jr., THPO Tunica - Biloxi Tribe 151 Melacon Dr. Marksville, LA 71351 earlii@tunica.org
Lovelin Poncho, Chairman Coushatta Indian Tribe P.O. Box 818 Elton, LA 70532	Send Hard Copy to Mike Tarpley Linda Langley, THPO Mike Tarpley, Deputy THPO P.O. Box 818 Elton, LA 70532 llangley@mcneese.edu; kokua.aina57@gmail.com
Only send email to Preservation Officer Gregory Pyle, Chief Choctaw Nation of Oklahoma Drawer 1210 Durant, Oklahoma 74702-1210	Ian Thompson PhD, RPA, THPO, Tribal Archaeologist, Director Historic Preservation Dept. Johnnie L. Jacobs, Section 106 Coordinator 580-775-0914, 580-920-3181 (Fax) 1-800-522-6170 ext. 2216 P.O. Drawer 1210 Durant, OK 74702 ithompson@choctawnation.com; jjacobs@choctawnation.com
George Wickliffe, Chief United Keetoowah Band of Cherokee P. O. Box 746 Tahlequah, Oklahoma 74465	Ms. Lisa LaRue-Baker, THPO P.O. Box 746 Tahlequah, OK 74465 UKBTHPO-LARUE@Yahoo.com
Only send email to Preservation Officer Tarpie Yargee, Chief Alabama-Quassarte Tribal Town P.O. Box 187 Wetumka, OK 74883	Augustine Asbury, 2nd Chief/ Tribal Historic Preservation Officer P.O. Box 187 Wetumka, OK 74883 aqttcultural@yahoo.com
Bill John Baker, Principal Chief Cherokee Nation of Oklahoma P. O. Box 948 Tahlequah, Oklahoma 74465	Dr. Richard Allen, Cultural/Historic Preservation P.O. Box 948 Tahlequah, OK 74465 Richard-Allen@cherokee.org

Original letters to these	CC letters to these
Leonard Harjo, Principal Chief Seminole Nation of Oklahoma P.O. Box 1498 Wewoka, Oklahoma 74884	Natalie Harjo, Cultural Preservation Office P.O. Box 1768 Seminole, OK 74868-1768 harjo.n@sno-nsn.gov
George Tiger, Principal Chief Muscogee (Creek) Nation of Oklahoma P.O. Box 580 Okmulgee, Oklahoma 74447	Emman Spain, THPO Terry Cole, Deputy THPO Muscogee (Creek) Nation of Oklahoma P.O. Box 580 Okmulgee, OK 74447 espain@muscogeenation-nsn.gov; tdcole@mcn-nsn.gov 918-732-7731
John D. Red Eagle, Principal Chief Osage Nation Executive Branch 627 Grandview Pawhuska, Oklahoma 74056	Dr. Andrea Hunter, Director, Tribal Historic Preservation Officer 627 Grandview Pawhuska, Oklahoma 74056 ahunter@osagetribe.org
Honorable Bill Anoatubby Governor of the Chickasaw Nation P.O. Box 1548 Ada, Oklahoma 74821	Ms. Amber Jarrett, Historic Preservation Manager LaDonna Brown, Historic Preservation Officer Chickasaw Nation P.O. Box 1548 Ada, OK 74821 amber.jarrett@chickasaw.net; ladonna.brown@chickasaw.net
George Scott, Mekko Thlopthlocco Tribal Town P.O. Box 188 Okemah, Oklahoma 74859	Charles Coleman, THPO P.O. Box 188 Okemah, Oklahoma 74859 chascoleman75@yahoo.com
Mekko Tiger Hobia Kialagee Tribal Town P.O. Box 332 Wetumka, OK 74883 Tel# (405) 452-3263, Fax# 452-3413	Henry Harjo, Cultural Specialist hharjo@yahoo.com 405-452-3262

Proposed Federal Oil and Gas Lease
EOI 1561



2,000 1,000 0 2,000 4,000 6,000 8,000 Feet

Proposed Lease Area

Proposed Lease Area:
Pope County, Arkansas, 5th Principal Meridian
T. 9N., R. 21W., Sec.5, SWSE
Approximately 39.86 acres.

U.S. Department of the Interior
Bureau of Land Management
Eastern States
Southeastern States Field Office
Jackson, Mississippi

This map contains portions of the following USGS 1:24,000 Topographic Ouadrangles: Lee Mountain, Knoxville

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of this data for individual use or aggregate use with other data.

United States Department of the Interior

Bureau of Land Management
Southeastern States Field Office
411 Briarwood Drive, Suite 404
Jackson, Mississippi 39206
http://www.es.blm.gov

IN REPLY REFER TO: 8100 (020) JMS Pope Co. EOI 1561

Jan. 13, 2014

Ms. Cathie Mathews
State Historic Preservation Officer
1500 Tower Building
323 Center Street
Little Rock, Arkansas 72201

Dear Ms. Mathews:

The Bureau of Land Management (BLM) has received an Expression of Interest (EOI 1561) to lease federal minerals under privately owned surface, i.e. split-estate minerals. The Bureau's Reasonably Foreseeable Development scenario (RFD) for this proposed lease is one well to be drilled from one pad, to be constructed on private surface with no more than 2.34 acres total, access road and pad, to be disturbed accessing federal minerals. However, proposed development locations have not been determined on a site-specific basis. Specific locations proposed for development are determined by the developer and surface owners.

The legal locations of the approximately 39.86 acres of federal mineral tracts are as follows (map enclosed):

5th Principal Meridian
Pope County (Lee Mountain and Knoxville Quadrangles)
T. 9 N., R. 21 W., Sec. 5, SWSE (Total 39.86 ac.)

A section of the lease document will state that before the BLM approves any development proposal, a survey that meets current professional standards and a report that meets Arkansas Historic Preservation Program requirements may be required on a site-specific basis. A report of survey results must be approved by both the Arkansas Historic Preservation Program and the BLM before any ground disturbing activities take place. Any needed consultation will be concluded before ground-disturbing activities begin.

In addition, if a development proposal, Notice of Staking (NOS) or Application for Permit to Drill (APD) is submitted, a stipulation will be included which covers accidental discovery and requires additional consultation with both your office and the appropriate federally recognized Native Americans.

Your concurrence of (1) a survey may be required when a NOS or APD is submitted, (2) additional consultation will be concluded before ground-disturbing activities begin, and (3) the addition of a stipulation covering accidental discovery when a NOS or APD is submitted, is requested within 30 days. If you have any questions or comments, please contact John M. Sullivan, Archeologist, at (601) 977-5439 or John_M_Sullivan@BLM.Gov.

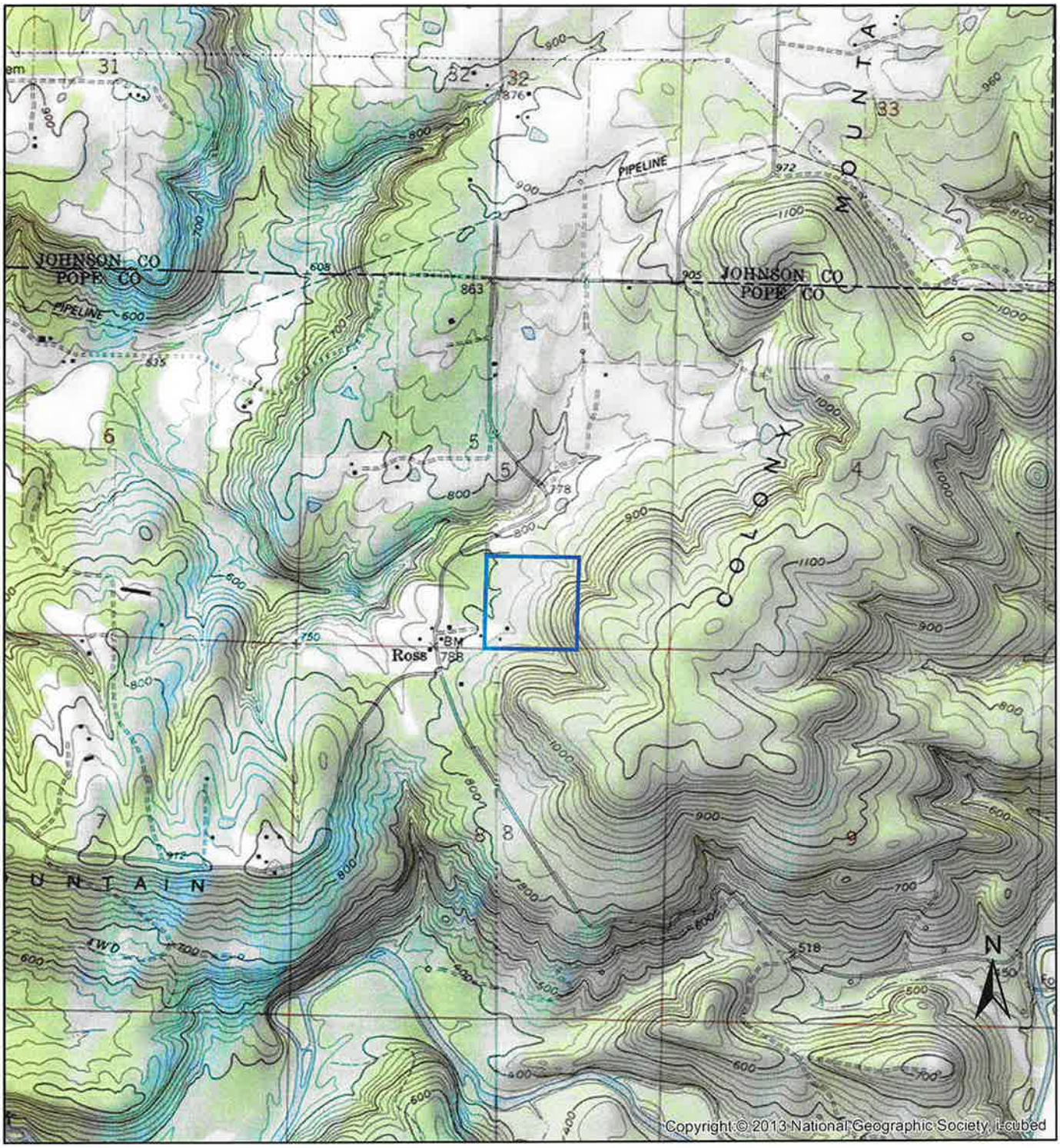
Sincerely,
Original Signed
Duane Winters

Duane Winters
Assistant Field Manager
Natural Resources Program Specialist

Enclosures
1 - Map

bc:
SSFO CF & RF
ES RF
DWinters
AMcMartney
ES020:JMSullivan:01/10/2014:601-977-5400:Pope Co.T.9N.R.21W.Sec.5.EOI 1561.SHPO Ltr

Proposed Federal Oil and Gas Lease
EOI 1561



2,000 1,000 0 2,000 4,000 6,000 8,000 Feet

Proposed Lease Area

Proposed Lease Area:
Pope County, Arkansas, 5th Principal Meridian
T. 9N., R. 21W., Sec.5, SWSE
Approximately 39.86 acres.

U.S. Department of the Interior
Bureau of Land Management
Eastern States
Southeastern States Field Office
Jackson, Mississippi

This map contains portions of the following USGS 1:24,000 Topographic Ouadrangles: Lee Mountain, Knoxville

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of this data for individual use or aggregate use with other data.

THE DEPARTMENT OF ARKANSAS
HERITAGE

Asa Hutchinson
Governor

Stacy Hurst
Director

Arkansas Arts Council

Arkansas Historic
Preservation Program

Delta Cultural Center

Historic Arkansas Museum

Mosaic Templars
Cultural Center

Old State House Museum

ARKANSAS NATURAL HERITAGE COMMISSION

323 Center Street, Suite 1500
Little Rock, AR 72201

(501) 324-9619
fax: (501) 324-9618
tdd: 711

e-mail:
info@naturalheritage.com
website:
www.naturalheritage.com

An Equal Opportunity Employer

Date: January 30, 2015
Subject: Elements of Special Concern
BLM Proposed Lease Areas
EOI 1552, 1561, 1791
ANHC No.: F-BLM.-14-004

Ms. Alison McCartney
Bureau of Land Management
411 Briarwood Drive, Suite 404
Jackson, MS 39206

Dear Ms. McCartney:

Staff members of the Arkansas Natural Heritage Commission have reviewed our files for records indicating the occurrence of rare plants and animals, outstanding natural communities, natural or scenic rivers, or other elements of special concern within or near the following sites:

EOI #	County	Quad. Name	Location
1561	Pope	Knoxville 7.5' Lee Mountain 7.5'	T9N/R21W/S5
1552	Logan	Caulksville 7.5' Paris 7.5'	T7N/R26W/S22, S23
1791	Pope	Knoxville 7.5'	T9N/R22W S12

Following is a summary of our review for each EOI:

EOI 1561

Section 5, T9N/R21W
No elements of special concern have been recorded for this tract.

EOI 1552

Section 22, T7N/R26W
No elements of special concern have been recorded for this tract.

Section 23, T7N/R26W
No elements of special concern have been recorded for this tract. It is of note that Northern long-eared bat (*Myotis septentrionalis*) has been recorded along Short Mountain Creek approximately 2 miles to the southeast of this tract. This is a forest bat that has been proposed for listing as endangered by the U.S. Fish and Wildlife Service.

EOI 1794

Section 12, T9N/R22W
No elements of special concern have been recorded for this location. It is of note that Big Piney Creek flows through this tract. At this location Big Piney Creek is designated as an Extraordinary Resource Water by the Arkansas Department of Environmental Quality under its Regulation No. 2. It has also been recognized on the state's registry of Natural and Scenic Rivers.

Lists of elements of special concern known to occur within five miles of each of the lease tracts are enclosed for your reference. The lists have been annotated to indicate those elements known to occur within a one mile radius of each tract. A legend is provided to help you interpret the codes used on the lists.

Please keep in mind that the project areas may contain important natural features of which we are unaware. Staff members of the Arkansas Natural Heritage Commission have not conducted field surveys of the study sites. Our review is based on data available to the program at the time of the request. It should not be regarded as a final statement on the elements or areas under consideration. Because our files are updated constantly, you may want to check with us again at a later time.

Thank you for consulting us. It has been a pleasure to work with you on this study.

Sincerely,

Cindy Osborne

Cindy Osborne
Data Manager/Environmental Review Coordinator

Enclosures: Element List (annotated)
Legend

IN REPLY REFER TO:

United States Department of the Interior

FISH AND WILDLIFE SERVICE
110 S. Amity Road, Suite 300
Conway, Arkansas 72032
Tel.: 501/513-4470 Fax: 501/513-4480

March 2, 2015

Alison McCartney
Bureau of Land Management
411 Briarwood Drive, Suite 404
Jackson, MS 39206

Dear Ms. McCartney:

The US Fish and Wildlife Service (Service) has reviewed the information supplied in your letter, dated January 15, 2015, regarding the proposed expression of interest for leasing of subsurface federal minerals at three sites (EOI# 1552, EOI# 1561, EOI# 1791) near the cities of Ross in Pope County and Paris in Logan County, Arkansas. Our comments are submitted in accordance with the Endangered Species Act (ESA; 87 Stat. 884, as amended 16 U.S.C. 1531 et seq.), Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d), and Fish and Wildlife Coordination Act (48 Stat. as amended; 16 U.S.C. et seq.).

The Service concurs with your determination for project EOI# 1552 that the proposed project may affect, but is not likely to adversely affect the American Burying Beetle (*Nicrophorus americanus*), Ozark Big-eared Bat (*Corynorhinus townsendii ingens),* or the proposed endangered Northern Long-eared Bat *(Myotis septentrionalis).* The Service concurs with your determination that proposed project EOI# 1552 will have no effect on the Piping Plover (*Charadrius melodus*), Arkansas River Shiner (*Notropis girardi*), or Interior Least Tern (*Sterna antillarum athalassos*).

The Service concurs with your determination for project EOI# 1561 that the proposed project may affect, but is not likely to adversely affect the Ozark Big-eared Bat (*Corynorhinus townsendii ingens),* Indiana Bat (*Myotis sodalis*), Gray Bat (*Myotis grisescens*), or the proposed endangered Northern Long-eared Bat *(Myotis septentrionalis).* The Service concurs with your determination that proposed project EOI# 1561 will have no effect on the Piping Plover (*Charadrius melodus*), Rabbitsfoot (*Quadrula cylindrica cylindrica*), Speckled Pocketbook (*Lampsilis streckeri*), Snuffbox (*Epioblasma triquetra*), Yellowcheek Darter (*Etheostoma moorei*), or Interior Least Tern (*Sterna antillarum athalassos*).

The Service concurs with your determination for project EOI# 1791 that the proposed project may affect, but is not likely to adversely affect the Ozark Big-eared Bat (*Corynorhinus townsendii ingens),* Indiana Bat (*Myotis sodalis*), Gray Bat (*Myotis grisescens*), the proposed endangered Northern Long-eared Bat *(Myotis septentrionalis),* Rabbitsfoot (*Quadrula cylindrica cylindrica*), Speckled Pocketbook (*Lampsilis streckeri*), Snuffbox (*Epioblasma triquetra*), Yellowcheek Darter (*Etheostoma moorei*), or Interior Least Tern (*Sterna antillarum athalassos*).

The Service concurs with your determination for project EOI# 1791 that the proposed project will have no effect on the Piping Plover (*Charadrius melodus*).

Please be aware Bald Eagle is not protected under the ESA. Bald Eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*).

We appreciate your interest in the conservation of endangered species. If you have any questions, please contact the Arkansas Ecological Services Staff at (501) 513-4487.

Sincerely,

For Melvin Tobin
Acting Project Leader

APPENDIX D

RFD

REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

Case File Number: EOI 1552

Project Number: DOI-BLM-ES-0020-2012-0025-EA

Acres: 100

Location: AR, Logan County, T7N, R26W, Sec. 22, SWNW, NWSW, Sec. 23, N2SESE

I. Reasonably Foreseeable Development

A. RFD Baseline Scenario Assumptions and Discussion

Objective is Middle Atoka. Commodity is natural gas.

Federal acreage with be incorporated into a state determined drilling unit. Drilling and production units are 640 acres. Project 2 wells drilled from 2 pads.

A 30' wide well access road will be constructed consisting of a 16' wide travel surface with a 7' buffer on each side.

If productive, multiple wells may be drilled from the existing pad.

If productive, oil and gas handling and production facilities will be constructed on the existing pad.

If productive, the reserve pit and part of the drill pad will be reclaimed when drilling and completion activities are concluded.

All disturbed acreage will be reclaimed if the well is non-productive.

B. Surface Disturbance Due to Oil and Gas Activity

Access Roads: .68 acres (1000' X 30')

Well Pads & Pits: 2.87 acres (2 X 250' X250')

Utility and/or Pipeline R.O.W: 0 – Use access road ROW

Initial Disturbance: 3.55 acres

Partial Reclamation of Drill Sites: .68 acres

Net Disturbance for Productive Wells: 2.87 acres

REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

Case File Number: EOI 1561

Project Number:

Acres: 39.86

Location: 5th Principal Meridian, Arkansas, Pope County, T9N, R21W, Sec. 5, SWSE.

I. Reasonably Foreseeable Development

A. RFD Baseline Scenario Assumptions and Discussion

Objective is Pennsylvanian Atokan or Morrowan Sands. Commodity is natural gas.

Federal acreage with be incorporated into a state determined drilling unit. Drilling and production units are 640 acres. Project 1 well to be drilled from 1 pad.

A 30' wide well access road will be constructed consisting of a 16' wide travel surface with a 7' buffer on each side.

If productive, multiple wells may be drilled from the existing pad.

If productive, oil and gas handling and production facilities will be constructed on the existing pad.

If productive, the reserve pit and part of the drill pad will be reclaimed when drilling and completion activities are concluded.

All disturbed acreage will be reclaimed if the well is non-productive.

B. Surface Disturbance Due to Oil and Gas Activity

Access Road: .91 acres (1320'X30')

Well Pad & Pit: 1.43 acres (250'X250')

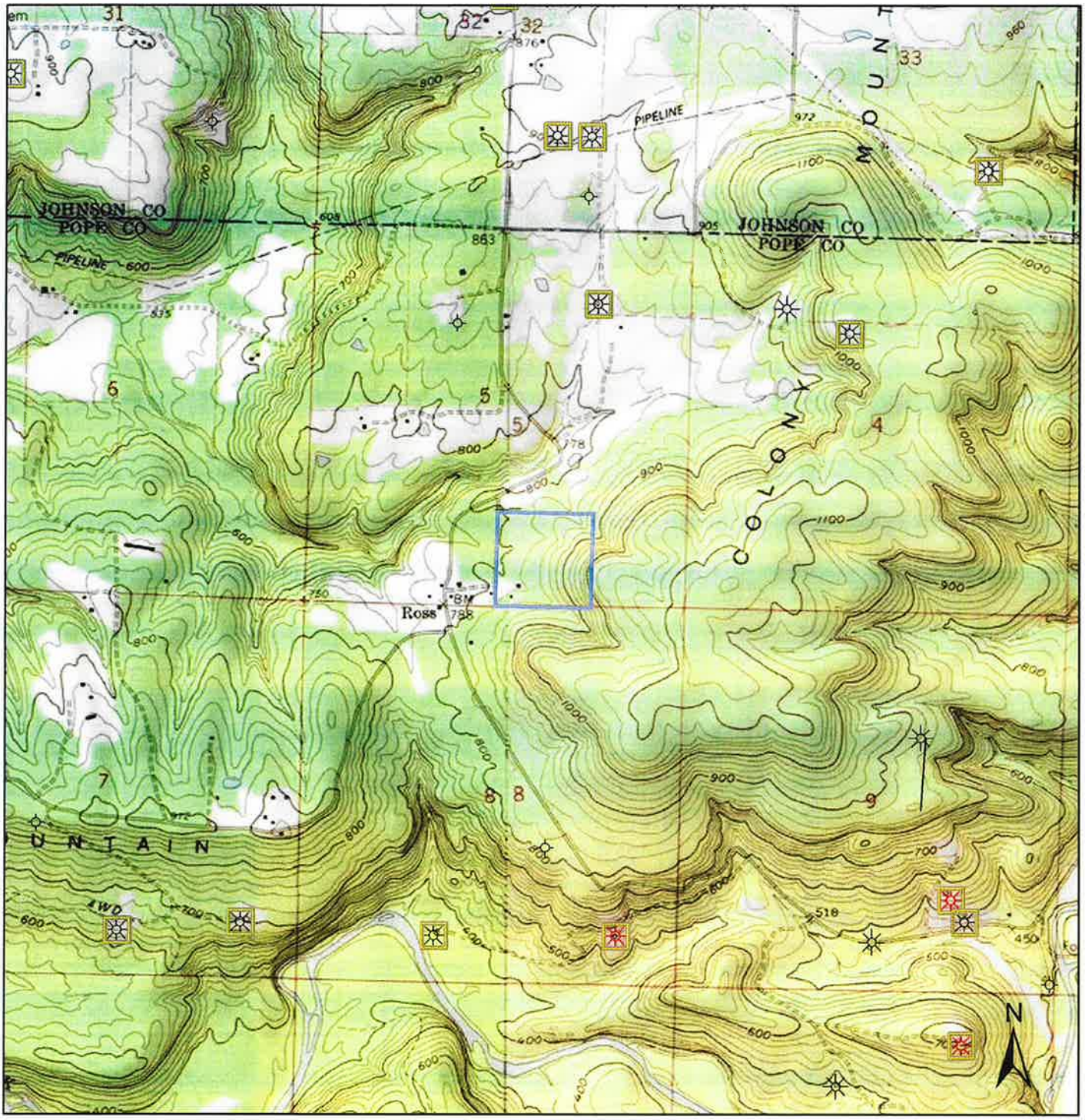
Utility and/or Pipeline R.O.W: 0 – Use access road ROW

Initial Disturbance: 2.34 acres

Partial Reclamation of Drill Site: 0.34 acres

Net Disturbance for Productive Well: 2.00 acres

Proposed Federal Oil and Gas Lease
EOI 1561



2,000 1,000 0 2,000 4,000 Feet

Proposed Lease Area

Oil and Gas Wells

- Dry Hole, Temporarily Abandoned
- Gas Well
- Multiple Completion, Gas
- Inactive Wells
- Well Bore Path

Proposed Lease Area:
Pope County, Arkansas, 5th Principal Meridian
T. 9N., R. 21W., Sec.5, SWSE
Approximately 39.86 acres.

U.S. Department of the Interior
Bureau of Land Management
Eastern States
Southeastern States Field Office
Jackson, Mississippi

This map contains portions of the following USGS 1:24,000 Topographic Ouadrangles: Lee Mountain. Knoxville

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of this data for individual use or aggregate use with other data.

APPENDIX E

Public Notice

LEGAL NOTICE

The Bureau of Land Management, Southeastern States Field Office will prepare an environmental assessment document to consider leasing federally owned mineral estate for oil and gas exploration and development.

The locations of the tracts are as follows:

T10N, R5W, Sec. 13, NENE, Jackson County (40 acres) (EOI #1492), T7N, R26W, Sec. 22, SWNW, NWSW, Sec. 23, N2SESE, Logan County (100 acres) (EOI #1552), and T9N, R21W, Sec. 5, SWSE, Pope County (40 acres) (EOI #1561). All three EOIs are located in the Fifth Principal Meridian, Arkansas.

The analysis will be prepared by an interdisciplinary team. An issue to be addressed by the team is to identify environmental impacts, and what restrictions may be necessary to avoid or mitigate identified impacts. The public is invited to participate by submitting comments on environmental issues with land use or by submitting other issues for consideration with the land use. Comments will be accepted through December 14, 2014. Send comments to Bureau of Land Management, Southeastern States Field Office, 411 Briarwood Drive, Suite 404, Jackson, MS 39206.

For further information contact Alison McCartney with the Southeastern States Field Office at (601) 977-5407.

Bruce E. Dawson
Field Manager

This Legal Published in The Courier November 7, 2014.

PROOF OF PUBLICATION

STATE OF ARKANSAS
COUNTY OF POPE } **SS:**

I, Katelyn McAlister of The Courier, a newspaper published at Russellville, Arkansas, and having a bona fide circulation in Pope County, Arkansas, for one year next preceding the first insertion of, and during the publication of the Notice hereto attached, do solemnly swear that said Notice was published in the above named

paper 1 issues consecutively bearing date of

November 7. 20 14

Legal Notice

Land management

Printer's Fee $ 106.40/00

Subscribed and sworn to before the undersigned, this 7th day of November. 20 14

My commission expires 10-01. 20 20

SHEILA PORTER
Notary Public
YELL COUNTY, ARKANSAS
My Commission Expires 10-01-2020

Sheila Porter
Notary Public

APPENDIX F
ANHC List of Special Status Species Records

Arkansas Natural Heritage Commission
Department of Arkansas Heritage
Elements of Special Concern

EOI #1552 (Five-mile radius)

Scientific Name	Common Name	Federal Status	State Status	Global Rank	State Rank
Animals-Invertebrates					
Isoperla szczytkoi	Magazine stripetail	-	INV	G1	S1
Nicrophorus americanus	American burying beetle	LE	SE	G2G3	S1
Speyeria diana	Diana Fritillary	-	INV	G3G4	S2S3
Animals-Vertebrates					
Aimophila ruficeps	Rufous-crowned Sparrow	-	INV	G5	S1
Myotis septentrionalis	northern long-eared bat	PE	SE	G2G3	S2S3
Plants-Vascular					
Artemisia ludoviciana ssp. mexicana	white sagebrush	-	INV	G5T5?	S1S2
Cooperia drummondii	rain-lily	-	INV	G5	S1S2
Euphorbia longicruris	wedge-leaf spurge	-	INV	G4G5	S1
Galium texense	Texas bedstraw	-	INV	G4	S1
Juncus brachyphyllus	tufted-stem rush	-	INV	G5	S1
Plantago patagonica	woolly plantain	-	INV	G5	S2
Stachys iltisii	Ouachita hedge-nettle	-	INV	GNR	S3
Special Elements-Natural Communities					
Central Interior Highlands Dry Acidic Glade and Barrens		-	INV	GNR	SNR

* - No elements of special concern have been recorded within a one-mile radius of EOI 1552

EOI #1561 (Five-mile radius)

Scientific Name	Common Name	Federal Status	State Status	Global Rank	State Rank
Animals-Invertebrates					
Alasmidonta marginata	elktoe	-	INV	G4	S3
Cambarus causeyi	Boston Mountains crayfish	-	INV	G2	S1
Lasmigona costata	flutedshell	-	INV	G5	S3
Paduniella nearctica	nearctic paduniellan caddisfly	-	INV	G1G2	S1?
Villosa lienosa	little spectaclecase	-	INV	G5	S3
Animals-Vertebrates					
Etheostoma mihileze	sunburst darter	-	INV	G4	S3
Plants-Vascular					
Gratiola brevifolia	sticky hedge-hyssop	-	INV	G4	S3

* - No elements of special concern have been recorded within a one-mile radius of EOI 1561

EOI #1791 (Five-mile radius)

Scientific Name	Common Name	Federal Status	State Status	Global Rank	State Rank
Animals-Invertebrates					
Alasmidonta marginata	elktoe	-	INV	G4	S3
Lasmigona costata	flutedshell	-	INV	G5	S3
Animals-Vertebrates					
Haliaeetus leucocephalus	Bald Eagle	-	INV	G5	S3B,S4N
Moxostoma pisolabrum	pealip redhorse	-	INV	G5	S2?

* - No elements of special concern have been recorded within a one-mile radius of EOI 1791

LEGEND

STATUS CODES

FEDERAL STATUS CODES

C	=	Candidate species. The U.S. Fish and Wildlife Service has enough scientific information to warrant proposing this species for listing as endangered or threatened under the Endangered Species Act.
LE	=	Listed Endangered; the U.S. Fish and Wildlife Service has listed this species as endangered under the Endangered Species Act.
LT	=	Listed Threatened; the U.S. Fish and Wildlife Service has listed this species as threatened under the Endangered Species Act.
-PD	=	Proposed for Delisting; the U.S. Fish and Wildlife Service has proposed that this species be removed from the list of Endangered or Threatened Species.
PE	=	Proposed Endangered; the U.S. Fish and Wildlife Service has proposed this species for listing as endangered.
PT	=	Proposed Threatened; the U.S. Fish and Wildlife Service has proposed this species for listing as threatened.
T/SA E/SA	=	Threatened (or Endangered) because of similarity of appearance.

STATE STATUS CODES

INV	=	Inventory Element; The Arkansas Natural Heritage Commission is currently conducting active inventory work on these elements. Available data suggests these elements are of conservation concern. These elements may include outstanding examples of Natural Communities, colonial bird nesting sites, outstanding scenic and geologic features as well as plants and animals, which, according to current information, may be rare, peripheral, or of an undetermined status in the state. The ANHC is gathering detailed location information on these elements.
WAT	=	Watch List Species; The Arkansas Natural Heritage Commission is not conducting active inventory work on these species, however, available information suggests they may be of conservation concern. The ANHC is gathering general information on status and trends of these elements. An "*" indicates the status of the species will be changed to "INV" if the species is verified as occurring in the state (this typically means the agency has received a verified breeding record for the species).
MON	=	Monitored Species; The Arkansas Natural Heritage Commission is currently monitoring information on these species. These species do not have conservation concerns at present. They may be new species to the state, or species on which additional information is needed. The ANHC is gathering detailed location information on these elememts
SE	=	State Endangered; this term is applied differently for plants and animals. Animals – These species are afforded protection under Arkansas Game and Fish Commission (AGFC) Regulation. The AGFC states that it is unlawful to import, transport, sell, purchase, hunt, harass or possess any threatened or endangered species of wildlife or parts. The AGFC lists as endangered any wildlife species or subspecies endangered or threatened with extinction, listed or proposed as a candidate for listing by the U.S. Fish and Wildlife Service or any native species or subspecies listed as endangered by the Commission. Plants – These species have been recognized by the Arkansas Natural Heritage Commission as being in danger of being extirpated from the state. This is an administrative designation with no regulatory authority.
ST	=	State Threatened; These species have been recognized by the Arkansas Natural Heritage Commission as being likely to become endangered in Arkansas in the foreseeable future, based on current inventory information. This is an administrative designation with no regulatory authority.

DEFINITION OF RANKS

Global Ranks

G1	=	Critically imperiled globally. At a very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.

G2	=	Imperiled globally. At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3	=	Vulnerable globally. At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4	=	Apparently secure globally. Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	=	Secure globally. Common, widespread and abundant.
GH	=	Of historical occurrence, possibly extinct globally. Missing; known from only historical occurrences, but still some hope of rediscovery.
GU	=	Unrankable. Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
GX	=	Presumed extinct globally. Not located despite intensive searches and virtually no likelihood of rediscovery.
GNR	=	Unranked. The global rank not yet assessed.
GNA	=	Not Applicable. A conservation status rank is not applicable.
T-RANKS=		T subranks are given to global ranks when a subspecies, variety, or race is considered at the state level. The subrank is made up of a "T" plus a number or letter (1, 2, 3, 4, 5, H, U, X) with the same ranking rules as a full species.

State Ranks

S1	=	Critically imperiled in the state due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors making it vulnerable to extirpation.
S2	=	Imperiled in the state due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it vulnerable to extirpation.
S3	=	Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4	=	Apparently secure in the state. Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	=	Secure in the state. Common, widespread and abundant.
SH	=	Of historical occurrence, with some possibility of rediscovery. Its presence may not have been verified in the past 20-40 years. A species may be assigned this rank without the 20-40 year delay if the only known occurrences were destroyed or if it had been extensively and unsuccessfully sought.
SU	=	Unrankable. Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SX	=	Presumed extirpated from the state. Not located despite intensive searches and virtually no likelihood of rediscovery.
SNR	=	Unranked. The state rank not yet assessed.
SNA	=	Not Applicable. A conservation status rank is not applicable.

General Ranking Notes

Q	=	A "Q" in the global rank indicates the element's taxonomic classification as a species is a matter of conjecture among scientists.
RANGES=		Ranges are used to indicate a range of uncertainty about the status of the element.
?	=	A question mark is used to denote an inexact numeric rank.
B	=	Refers to the breeding population of a species in the state.
N	=	Refers to the non-breeding population of a species in the state.